### गुरू घासीदास विश्वविद्यालय (केन्रीय विश्वविद्यालय अधिनयम 2009 क्र. 25 के अंतर्गत स्थापित केन्रीय विश्वविद्यालय) कोनी, बिलासपुर - 495009 (छ.ग.)



# Guru Ghasidas Vishwavidyalaya (A Central University Established by the Central Universities Act 2009 No. 25 of 2009) Koni, Bilaspur – 495009 (C.G.)

Department: Department of Pha	rmacy	
Academic Year: 2022_23		
S.No.	Programme Code	Name of the Programme
01	2022 337	M.Pharm (Pharmaceutics)

Following students have carried out their Project work/ Internship/ Field Project/Industrial Training for the academic session 2022-23

S.No.	Name of Students	Page No.
1	ANURADHA	1-4
2	AYUSHI SHARMA	5-10
3	BARUN RAJ	11-14
4	DHANRAJ PISA	15-19
5	DIVYA JAISWAL	20-25
6	JAY PRAKASH SAHU	26-29
7	JAYSHREE	30-34
8	KM POOJA	35-38
9	MANISH ROBBERT KOSHLE	39-45
10	NISHAT PARVEEN SIDDIQUI	46-51
11	PRINCE NIKHIL RATHOR	52-61
12	SAKSHI GUPTA	62-66
13	SHIVANI TOMAR	67-74
14	SNEHA CHAUDHARY	75-78
15	VIRENDRA KUMAR	79-82
16	MAYANK GARHEWAL	83-86



# IMPROVED ORAL BIOAVAILABILITY OF ANTIHYPERLIPIDEMIC AGENTS USING SELF MICROEMULSIFYING DRUG DELIVERY SYSTEM

Submitted for Partial Fulfillment of the Requirement for the Award of Degree of

> **Master of Pharmacy** (Pharmaceutics) (Session 2022-2023)



**SUBMITTED TO** Dr. Akhlesh K. Jain (Assistant Professor)

SUBMITTED BY dha Enroll: GGV/16/6071 1082101

DEPARTMENT OF PHARMACY, GURU GHASIDAS VISHWAVIDYALAYA, BILASPU

(A Central University Established by the Central University Act 2009 No. 25 of 2009) A Thesis on

## IMPROVED ORAL BIOAVAILABILITY OF ANTIHYPERLIPIDEMIC AGENTS USING SELF MICROEMULSIFYING DRUG DELIVERY SYSTEM

Submitted for

Partial Fulfillment of the Requirement for the Award of Degree of

Master of Pharmacy (Pharmaceutics)

(Session 2022-2023)



SUBMITTED TO Dr.Akhlesh K.Jain (Assistant Professor) SUBMITTED BY

Anuradha Enroll:GGV/16/6071 Roll No. 21082101

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

(A Central University Established by the Central University Act 2009 No. 2



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

(A Central University Established by the Central University Act 2009 No. 25 of 2009)
Tel.:07752-260027 (O); Fax; 07752-260148

#### FORWARDING CERTIFICATE

This is to certify that Anuradha D/O Mr. Rupdhar Ram is a student of M. Pharm 4<sup>th</sup> Semester in Department of Pharmacy, Guru Ghasidas Vishwavidyalaya, Bilaspur has submitted her Project entitled "Improved Oral Bioavailability of Antihyperlipidemic agents using self microemulsifying drug delivery system" for the partial fulfillment of the requirement for the degree of Master of Pharmacy (Pharmaceutics) under the supervision of Dr. Akhlesh K. Jain (Assistant Professor).

I hereby forward her project in M. Pharmacy (Pharmaceutics) during the academic session 2022-2023.

Date:

Place:

FORWARDED BY

Head of Department

Head

Department of Pharmacy
Guru Ghasidas Vishwavidyalaya
(A Central University)
Bilaspur (C.G.)

CHAPTER NO.	TITLE	PAGE NO.
1	INTRODUCTION	1-28
2	DRUGPROFILE	36-44
3	PRE-FORMULATIONSTUDY	44-53
4	FORMULATIONANDCHARACTERIZATION	55-77
5	IN-VIVOSTUDY	81-90
6	SUMMARYAND CONCLUSION	91-96
	REFERENCES	
REFERENCE	A.INTRODUCTION	29-35
	B.DRUGPROFILE	
	C.PRE-FORMULATIONSTUDY	54
	D.FORMULATIONANDCHARACTERIZATION	78-80
	E.IN-VIVOSTUDY	

## DEVELOPMENT AND CHARACTERIZATION OF DEXAMETHASONE LOADED LIPID BASED NANOCARRIER FOR EFFECTIVE TREATMENT OF RHEUMATOID ARTHRITIS

Dissertation Submitted for the Partial Fulfillment of the Requirement for The Award of Degree of

> MASTER OF PHARMACY (PHARMACEUTICS)



SESSION 2022-2023

#### Supervised by:

DR. K. KESAVAN

M. PHARM. PH.D. ASSISTANT PROFESSOR (PHARMACEUTICS)

#### Submitted by:

MS. AYUSHI SHARMA

M. PHARM, IV SEM. (PHARMACEUTICS) ENROLL, NO.-GGV/21/06351 ROLL NO: 21082102

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

# DEVELOPMENT AND CHARACTERIZATION OF DEXAMETHASONE LOADED LIPID BASED NANOCARRIER FOR EFFECTIVE TREATMENT OF RHEUMATOID ARTHRITIS

A

Dissertation
Submitted for the Partial Fulfillment of the Requirement for
The Award of Degree of

MASTER OF PHARMACY (PHARMACEUTICS)



2022-2023

#### Supervised by:

DR. K. KESAVAN

M. PHARM. PH.D. ASSISTANT PROFESSOR (PHARMACEUTICS)

#### Submitted by:

MS. AYUSHI SHARMA

M. PHARM. IV SEM. (PHARMACEUTICS) ENROLL. NO.-GGV/21/06351 ROLL NO: 21082102

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



#### DEPARTMENT OF PHARMACY,

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

(A Central University Established by the Central University Act-2009 No-25 of 2009) Tel.No.07752-260027; FaxNo.07752-260148.

#### **FORWARDING** CERTIFICATE

This is to certify that Ms. Ayushi Sharma, M. Pharm. IV semester (Pharmaceutics) of this institute has submitted her Dissertation work entitled "Development and characterization of dexamethasone loaded lipid based nanocarrier for effective treatment of rheumatoid arthritis" for the partial fulfillment of the requirement for the award of degree of Master of Pharmacy (Pharmaceutics) with her truly & honestly observed inference during her research work under the supervision of Dr. K. Kesavan (M. Pharm., Ph.D.). Her work is original, satisfactory and is not submitted anywhere else for the award of any Degree.

I hereby forward the thesis to the Vishwavidyalaya for the Award of M. Pharm. degree in Pharmaceutics during the academic session 2022-2023.

Date: 04/12/2023

HEAD OF DEPARTMENT

Head

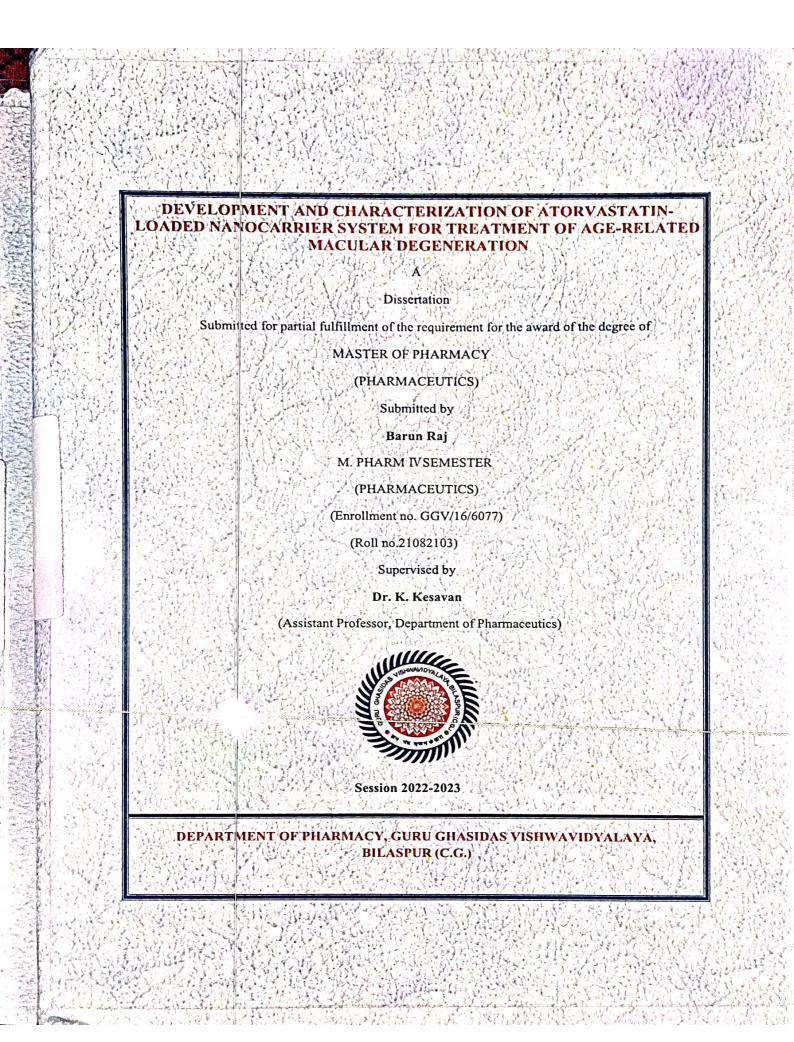
**Department of Pharmacy Guru Ghasidas Vishwavidyalaya** (A Central University) Bilaspur (C.G.)

#### LIST OF CHAPTERS

CHAPTERS	TITLE	PAGE NO
	CHAPTER-O1	<u>'</u>
1.	INTRODUCTION	1-2
1.1	Anatomy of Skin	2-4
1.2	Rheumatoid Arthritis	4-13
1.3	Solid Lipid Nanoparticle	13-17
NAME OF TAXABLE PARTY.	AIM AND OBJECTIVE	18
	CHAPTER-02	'
2.	LITERATURE OF REVIEW	19-24
2.1	Drug Profile	25-28
2.2	Excipient Profile	29-34
	CHAPTER-03	
3.	MATERIALS AND METHODS	
3.1	Materials	35
3.2	Preformulation Studies	35
3.2.1	Organoleptic Properties of Drug	35
3.2.2	Melting Point Determination	35
3.2.3	Solubility Study	36
3.2.4	Ultra-Violet (UV) Spectroscopy (λmax Determination)	36
3.2.5	Preparation of Calibration Curve of Dexamethasone Sodium	36
	Phosphate	
3.2.6	FT-IR Spectrum of Drug, Excipients, and Developed	37
	formulations.	
3.3	Method of Preparation	37
3.3.1	Preparation of Solid Lipid Nanoparticles	37-38
3.3.2	Optimization of SLNs	38-39
3.3.3	Optimization of CN Coated DSP Loaded SLNs Topical Gel	39
3.4	Characterization of Developed Formulation	39
3.4.1	Determination of particle size and PDI	39
3.4.2	Determination of Zeta potential	39

3.4.3	Determination of the entrapment efficiency percentage (EE%)	40
3.4.4	Determination of percentage drug loading	40
3.4.5	Measurement of pH	40
3.4.6	Measurement of Viscosity	40
3.4.7	Transmission Electron Microscope	41
3.4.8	In vitro drug release studies	41
3.4.9	Mechanism of drug Release	41
3.4.10	Visual appearance and pH	42
3.4.11	Estimation of drug content	42
3.4.12	Rheological study	42
3.5	Ex-vivo skin permeation study	42
3.6	In-vivo Characterization	42-43
3.6.1	Induction of RA and Intra-Articular Injection Procedure	43
3.6.2	Animal Study Protocol.	43
3.6.3	Assessment of anti-arthritic effects of developed formulation.	43
3.6.4	Statistical Analysis	43
	CHAPTER-04	
4.	RESULTS AND DISCUSSION	
4.1	Preformulation Studies	44
4.1.1	Organoleptic properties of drug	44
4.1.2	Melting point	45
4.1.3	Solubility study	45-46
4.1.4	UV Spectrum of Dexamethasone sodium phosphate	46
4.1.5	Preparation of calibration curve of Dexamethasone sodium phosphate in PBS (PH 7.4)	47
4.1.6	FT-IR Spectrum of Drug, Excipients and Developed Formulations	48-55
4.2	METHOD OF PREPARATION	55
4.2.1	Preparation of DSP loaded Solid lipid Nanoparticles (SLNs)	55
4.2.2	Optimization of SLNs on the basis of various parameters	55-57
4.2.3	Chitosan coating of DSP loaded SLNs	57
4.2.4	Preparation of chitosan coated dexamethasone sodium phosphate	58

	loaded solid lipid nanoparticles topical gel	
4.3	Characterization of DSP-SLNs, CN Coated SLNs And CN Coated DSP Loaded SLNs Gel	58
4.3.1	Determination of particle size and PDI	58-59
4.3.2	Determination of Zeta potential	60-61
4.3.3	Determination of Entrapment Efficiency and Drug loading	61
4.3.4	Determination of pH and Viscosity	61-62
4.3.5	Transmission Electron Microscopy	62-63
4.3.6	In Vitro drug release	64-65
4.3.7	Mechanism of drug release	65-68
4.3.8	Visual appearance, pH and drug content	68
4.4	Ex-vivo skin permeation	68-69
4.5	In-Vivo Study	69-71
	CHAPTER-05	
5	SUMMARY AND CONCLUSION	72-74
	CHAPTER-06	
6	BIBLIOGRAPHY	75-84



### DEVELOPMENT AND CHARACTERIZATION OF ATORVASTATIN-DED NANOCARRIER SYSTEM FOR TREATMENT OF AGE-RELATED MACULAR DEGENERATION

A

Dissertation

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

MASTER OF PHARMACY

(PHARMACEUTICS)

Submitted by

Barun Raj

M. PHARM IV SEMESTER

(PHARMACEUTICS)

(Enrollment no. GGV/16/6077)

(Roll no.21082103)

Supervised by

Dr. K. Kesavan

(Assistant Professor, Department of Pharmaceutics)



Session 2022-2023

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



# DIPARTMENT OF PHARMACY <u>GURU CHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.). 495009</u>

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

#### **FOR WARDING CERTIFICATE**

This is to certify that Mr. Barun R aj of M. Pharm 4th Semester (Pharmaceutics), bearing Enrollment no. GGV/15/5077 has submitted Master of Pharmacy dissertation entitled as "Development and characterization of attervastation-headed manucarrier system for treatment of age-related macrollar degeneration", for the partial fulfillment of the requirement for the degree of Master of Pharmacy (Pharmaceutics). He has submitted his Dissertation under the supervision of Dr. K. Kesavan (Assistant Professor, Department of Pharmaceutics) his dissertation is satisfactory, original and is not submitted anywhereelse for the award of any degree.

Thereby forward his dissertation for M. Pharm degree in Pharmaceutics during the academic session 2022-2023

Date: 04 12 2023

Frof. Bharti Ahirwar

Head of Department Head

Department of Pharmacy

Jury Ghasidas Vishwavidyalaya

(A Central University)

Bilaspur (C.G.)

TER TITLE	PAGE
	NUMBER
INTRODUCTION	- O George Communication of Communicatio
Anatomy and Physiology of Eye	1-5
Barriers in Ocular Drug Delivery	5-6
Macular Degeneration	
Risk Factor	6-7
Pathophysiology	8-9
Diagnosis	9-10
Treatment	11-14
Epidemiology	14
Ocular Drug Delivery System	14-17
Application of Micelles	17-19
Micelles Preparation Techniques	19-21
Characterization of Micelles	22-23
Aim and Objective	24
LITERATURE REVIEW	
Literature Review	25-27
Drug Profile	28-33
Excipients Profile	34-36
MATERIAL AND METHODS	
	37
Preformulation Studies	37-39
TO ANY	39-40
	40-43
RESULTS AND DISCUSSION	
The state of the s	
	44
	45
	45
	46
	INTRODUCTION  Anatomy and Physiology of Eye  Barriers in Ocular Drug Delivery  Macular Degeneration  Risk Factor  Pathophysiology  Diagnosis  Treatment  Epidemiology  Ocular Drug Delivery System  Application of Micelles  Micelles Preparation Techniques  Characterization of Micelles  Aim and Objective  LITERATURE REVIEW

# ENHANCEMENT OF ANTIMICROBIAL EFFICACY OF CURCUMIN

A

Dissertation

Submitted for the partial fulfilment of the requirement for The Award of Degree of

**MASTER OF PHARMACY (PHARMACEUTICS)** 



2021-2023

Supervised by
Dr. Manoj Kumar
M.Pharm., Ph.D.
ASSISTANT PROFESSOR
(PHARMACEUTICS)

Submitted by

Dhanraj Pisda

M. Pharm final semester

(PHARMACEUTICS)

Enroll no: GGV/21/06352

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

# NHANCEMENT OF ANTIMICROBIAL EFFICACY OF CURCUMIN

A

Dissertation

Submitted for the partial fulfilment of the requirement for The Award of

Degree of

**MASTER OF PHARMACY (PHARMACEUTICS)** 



Supervised by Dr. Manoj Kumar

M.Pharm., Ph.D.

ASSISTANT PROFESSOR (PHARMACEUTICS)

Submitted by **Dhanraj Pisda** 

M. Pharm final semester

(PHARMACEUTICS)

Enroll no: GGV/21/06352

**DEPARTMENT OF PHARMACY** 

**GURU GHASIDAS VISHWAVIDYALAYA** 

BILASPUR (C.G.)

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



A Central University Established by the Central University Act-2009 No-25 of2009)

Tel.No.07752-260027; Fax No.07752-260148

#### FORWARDING CERTIFICATE

This is to certify that Mr. Dhanraj Pisda M. Pharm final semester (Pharmaceutics) of this institute has submitted his dissertation work entitled "Biofilm targeted mucoadhesive emulsion for enhancement of antimicrobial efficacy of curcumin" for the partial fulfilment of the requirement for the award of the degree of Master of Pharmacy (Pharmaceutics) with his truly and honestly observed inference during his research work under the supervision of Dr. Manoj Kumar. His work is original, satisfactory and is not submitted anywhere else for the award of any degree.

I hereby forward his thesis for the award of M. Pharm degree in Pharmaceutics during the academic session 2021-2023.

Date: 04 - 12 - 23

Head of Department



#### DEPARTMENT OF PHARMACY

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

(A Central University Established by the Central University Act-2009 No-25 of 2009) Tel.No.07752-260027; FaxNo.07752-260148

#### CERTIFICATE

This is to certify that Mr. Dhanraj Pisda S/o Mr. Omu Ram Pisda, M. Pharm final semester (Pharmaceutics) of Department of Pharmacy has submitted his dissertation work entitled "Biofilm targeted mucoadhesive emulsion for enhancement of antimicrobial efficacy of curcumin" for the partial fulfilment of the requirement for the award of Degree of Master of Pharmacy (Pharmaceutics) with his truly & honestly observed inference during his research work. He has completed his project work under my guidance. His work is original, satisfactory and is not submitted anywhere else for any degree.

I hereby forward his thesis for the award of Master of Pharmacy (Pharmaceutics) during the academic session 2021-2023.

Assistant Professor (Pharmaceutics)

(Supervisor)

## **INDEX**

S.NO.	CONTENT	PAGE
	THE RESERVE THE PARTY OF THE PA	NO.
1	INTRODUCTION	1-38
2	DRUG AND EXCIPIENT PROFILE	39-45
3	PRE-FORMULATION STUDY	46-64
4	FORMULATION AND CHARACTERIZATION	65-97
5	ANTIBIOFILM STUDY	98-113
6	SUMMARY AND CONCLUSION	114-116

#### A DISSERTATION

ON

# LINEZOLID LOADED FILM FORMING SOLUTION FOR THE TREATMENT OF DIABETIC FOOT ULCER

SUBMITTED FOR PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE OF

## MASTER OF PHARMACY (PHARMACEUTICS)

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



Submitted by

DIVYA JAISWAL
M.PHARMACY 4<sup>th</sup> SEMESTER
(PHARMACEUTICS)
ENROLL NO: GGV/21/06353
ROLL NO: 21082105

Under the supervision of

Dr. K.P. MEENA (M. Pharm., Ph.D.) ASSOCIATE PROFESSOR (PHARMACEUTICS)

DEPARTMENT OF PHARMACY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University Established by the Central University Act-2009 No. 25 of 2009)

#### A

#### DISSERTATION

ON

# LINEZOLID LOADED FILM FORMING SOLUTION FOR THE TREATMENT OF DIABETIC FOOT ULCER

SUBMITTED FOR PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE OF

#### **MASTER OF PHARMACY (PHARMACEUTICS)**

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



#### Submitted by

DIVYA JAISWAL M.PHARMACY 4<sup>th</sup> SEMESTER (PHARMACEUTICS) ENROLL NO: GGV/21/06353 ROLL NO: 21082105

Under the supervision of

Dr. K.P. MEENA (M. Pharm., Ph.D.) ASSOCIATE PROFESSOR (PHARMACEUTICS)

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

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



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

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

Tel. No. 07752-260027; Fax No. 07752-260148

#### FORWARDING CERTIFICATE

4th semester in Department of Pharmacy, Guru Ghasidas Vishwavidyalaya, Bilaspur has submitted her dissertation entitled "LINEZOLID LOADED FILM FORMING SOLUTION FOR THE TREATMENT OF DIABETIC FOOT ULCER" for the partial fulfilment of the requirement for the Degree of Master of Pharmacy (Pharmaceutics). She has submitted her synopsis under the supervision of Dr. K.P. MEENA (Associate Professor, Department of Pharmacy, Guru Ghasidas Vishwavidyalaya, Bilaspur). Her work is Original and satisfactory and is not submitted anywhere else for the award of any degree.

I recommend forwarding her thesis for the 2<sup>nd</sup> year project work in M. Pharm.

(Pharmaceutics) during the academic session 2022-2023.

Date:

Place: Bilaspur

FORWARDED BY

Dr. BHARTI AHIRWAR
HEAD OF DEPARTMENT
DEPARTMENT OF PHARMACY
GURU GHASIDAS VIVSHWAVIDYALAYA
BILASPUR (C.G)
Head

Department of Pharmacy
Guru Ghasidas Vishwavidyalaya
(A Central University)
Bilaspur (C.G.)

#### LIST OF CONTENT

S.No.	Chapters	Page no.
1.	Introduction	1-18
	1.1 Drug Delivery System  1.1.1 Advantages of topical route of administration 1.1.2 Film forming solution (FFS) 1.1.3 Topical route of administration 1.1.4 Advantages of FFS 1.1.5 Mechanism of action of FFS	1-4
	1.1.6 Properties of FFS 1.1.7 Component of FFS 1.2 Diabetic Foot Ulcer (DFU) 1.2.1 Management of DFU 1.2.2 Pathophysiology of DFU 1.2.3 Etiology of DFU	5-14
	1.2.4 Epidemiology of DFU 1.2.5 Treatment of DFU 1.2.6 Classification of DFU 1.3 Linezolid	14-15
	1.3.1 Indication 13.2 Mechanism of action 1.4 Optimization of formulation (DoE) by using central composite design 1.5 Conclusion 1.6 References	15-16 16 17-18
2.	Literature Review 2.1 Work Done on Film Forming Solution 2.2 Work Done on Drug 2.3 Work Done in Diabetic Foot Ulcer 2.4 References	19-24 19-20 20-21 21-22 23-24
3.	Drug & Excipient Profile 3.1 Drug profile of Linezolid 3.2 Excipient profile 3.2.1 Chitosan 3.2.2 Polyethylene Glycol 400	25-31 25-26 26-30
	3.2.3 Streptozotocin 3.3 References	31
4.	Research Envisaged and plan of work 4.1 research envisaged 4.2 aim of work 4.3 plan of work	32-33 32 32 33

Pre-formulation study	34-49
5.1Pre-formulation study	34-37
5.1.1 List of materials	
5.1.2 List of equipment	
5.1.3 Method	
5.1.4 Physicochemical and morphological characterization	
5.1.10 Chemical characterization of drug excipients mixture	
	38-48
5.2.4 determination of absorption maxima of linezolid	
s5.2.11 partition coefficient of linezolid	
5.3 References	49
Formulation and characterization	50-70
	50-56
6.1.1.1 Preparation of Ontimized Formulation by DoE	
	13
	300
Solution	
(12 FTID -t- de of antimized formulation	
6.1.3 FTIR study of optimized formulation	
6.1.4 In vitro study	
6.1.4 In vitro study 6.1.5 Ex vivo study	55.60
6.1.4 In vitro study 6.1.5 Ex vivo study 6.1.6 Kinetic studies of release data	57-69
6.1.4 In vitro study 6.1.5 Ex vivo study 6.1.6 Kinetic studies of release data 6.2 Result and discussion	57-69
6.1.4 In vitro study 6.1.5 Ex vivo study 6.1.6 Kinetic studies of release data 6.2 Result and discussion 6.2.1 Formulation development	57-69
6.1.4 In vitro study 6.1.5 Ex vivo study 6.1.6 Kinetic studies of release data 6.2 Result and discussion 6.2.1 Formulation development 6.2.2 Physicochemical Characterization of prepared film	57-69
6.1.4 In vitro study 6.1.5 Ex vivo study 6.1.6 Kinetic studies of release data 6.2 Result and discussion 6.2.1 Formulation development 6.2.2 Physicochemical Characterization of prepared film forming solution	57-69
6.1.4 In vitro study 6.1.5 Ex vivo study 6.1.6 Kinetic studies of release data 6.2 Result and discussion 6.2.1 Formulation development 6.2.2 Physicochemical Characterization of prepared film forming solution 6.2.3 FTIR spectrum of optimized formulation (F6)	57-69
6.1.4 In vitro study 6.1.5 Ex vivo study 6.1.6 Kinetic studies of release data 6.2 Result and discussion 6.2.1 Formulation development 6.2.2 Physicochemical Characterization of prepared film forming solution 6.2.3 FTIR spectrum of optimized formulation (F6) 6.2.4 Kinetics studies of the release data	57-69
6.1.4 In vitro study 6.1.5 Ex vivo study 6.1.6 Kinetic studies of release data 6.2 Result and discussion 6.2.1 Formulation development 6.2.2 Physicochemical Characterization of prepared film forming solution 6.2.3 FTIR spectrum of optimized formulation (F6) 6.2.4 Kinetics studies of the release data	57-69
6.1.4 In vitro study 6.1.5 Ex vivo study 6.1.6 Kinetic studies of release data 6.2 Result and discussion 6.2.1 Formulation development 6.2.2 Physicochemical Characterization of prepared film forming solution 6.2.3 FTIR spectrum of optimized formulation (F6)	57-69
	5.1.1 List of materials 5.1.2 List of equipment 5.1.3 Method 5.1.4 Physicochemical and morphological characterization of drug 5.1.5 Melting point 5.1.6 Fourier transform infrared spectral analysis 5.1.7 Determination of absorbance maxima 5.1.8 XRD study 5.1.9 Drug excipients compatibility 5.1.10 Chemical characterization of drug excipients mixture 5.1.11 Solubility study 5.1.12 Partition coefficient 5.2 Result and Discussion 5.2.1 identification and characterization of linezolid 5.2.2 melting point 5.2.3 DSC study 5.2.4 determination of absorption maxima of linezolid 5.2.5 calibration curve of Linezolid in phosphate buffer 5.2.6 Identification of drug by FTIR 5.2.7 chemical characterization of drug excipients compatibility studies 5.2.8 drug excipients compatibility study 5.2.9 XRD studies 5.2.10 solubility study of Linezolid s5.2.11 partition coefficient of linezolid

	6.3.3- Effect on drug release 6.4 Reference	70
7.	Stability studies	71-73
	7.1 stability studies	71-72
	7.2 stability studies of optimised formulation	71-72
	7.3 result and discussion	73
8.	In-Vivo study	74-78
0.	8.1 Grouping of animals	74-77
	8.2 Induction of diabetes	
	8.3 Surgical wounding procedure	
	8.4 Diabetic wound ulcer models	
	8.5 Conclusion	70
	8.6 References	78
9.	Histomorphology evaluation	81-83
7.	9.1 histomorphology evaluation of diabetic planter soft tissue	81
	9.2 Image analysis	81
	9.3 conclusion	82
	9.4 References	83
10.	Summary and conclusion	84-85

#### LIST OF TABLES

S.No.	Captions	Page no.
1.1	Ideal properties of the drug for film-forming solution	4
1.1	Feature of DFUs according to etiology	4
1.2	Category of solvents and their suitable example	11
1.3	Marketed formulation and its advantages, route of administration	13
1.4		- Table
	and limitation	13
1.5	Classification of DFUs	25-26
4.1	Description of linezolid drug	28
4.2	Description of streptozotocin	29
4.3	Description of chitosan	30
4.4	Description of PEG 400	34
5.1	List of material used in study	38
5.2	Identification and characterization of Linezolid	38
5.3	Melting point of pure drug	40
5.4	Parameters for calibration curve in pH 6.8 phosphate buffer	
	Solution Solution Solution Solution Solution	40-41
5.5	Absorbance of Linezolid in phosphate buffer at 251 nm	41
5.6	Interpretation of linezolid FTIR spectra	43
5.7	Interpretation of LNZ with chitosan	44-45
5.8	Interpretation of LNZ with physical mixture	46
5.9	Interpretation of PEG 400 with chitosan and LNZ	48
5.10	Solubility data of linezolid	49
5.11	Partition coefficient data of linezolid	52
6.1	Components for preparation of Film Forming Solution	



DEVELOPMENT AND
CHARACTERIZATION OF BIODEGRADABLE
POLYMERIC HYDROGEL SYSTEM FOR
COLON SPECIFIC TARGETING

Submitted for

Partial Fulfillment of the Requirement for the Award of Degree of Master of Pharmacy (Pharmaceutics)
(Session 2022-2023)



SUPERVISED BY Dr. S. K. Lanjhiyana Associate Professor (Pharmaceutics) SUBMITTED BY
Mr. Jay Prakash Sahu
Enroll: GGV/21/06354
Roll No. 21082106

DEPARTMENT OF PHARMACY,
GURU GHASIDAS VISHWAVIDYALAYA,
BILASPUR, CHHATTISGARH

Abid Printer 9770398993

#### A

#### Dissertation on

# DEVELOPMENT AND CHARACTERIZATION OF BIODEGRADABLE POLYMERIC HYDROGEL SYSTEM FOR COLON SPECIFIC TARGETING

#### Submitted for

Partial Fulfillment of the Requirement for the Award of Degree of Master of Pharmacy (Pharmaceutics)

(Session 2022-2023)



#### SUPERVISED BY

Dr. S. K. Lanjhiyana Associate Professor (Pharmaceutics)

#### SUBMITTED BY

Mr. Jay Prakash Sahu Enroll: GGV/21/06354 Roll No. 21082106

DEPARTMENT OF PHARMACY,

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR, CHHATTISGARH



#### DEPARTMENT OF PHARMACY

#### GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)

(A central University Established by the Central University Act 2009 No. 25 of 2009) Tel.: 07752-260027 (O); Fax; 07752-260148

#### **FORWARDING**

This is to certify that Mr. Jay Prakash Sahu s/o. Mr. Santosh Kumar Sahu student of M. Pharmacy (Pharmaceutics) in Department of Pharmacy has submitted his dissertation work entitled "Development and Characterization of Biodegradable Polymeric Hydrogel System for Colon Specific Targeting" for the partial fulfilment of the requirement of Master of Pharmacy (Pharmaceutics) with his truly and honesty observed inference during his project work. He has completed his project work under the supervision of Dr. S. K. Lanjhiyana (Associate Professor, Pharmaceutics). His work is satisfactory and is not submitted anywhere else for the award of any degree.

I hereby forward his dissertation work for the award of M. Pharmacy (Pharmaceutics) during the academic session 2022-23.

Forwarded by

**Head of Department** 

Head Department of Pharmacy Guru Ghasidas Vishwavidyalaya (A Central University) Bilaspur (C.G.)

## **CONTENTS**

S.N.	Content	Page No.
1	List of Tables	1
2	List of Figures	III
3	List of Abbreviations	VI
4	Index	VII

٨.

#### DISSERTATION

ON

### TARGETED SURFACE MODIFIED NANOCARRIERS OF AN ANTI-CANCER DRUG FOR GASTRIC CANCER

Submitted for

Partial fulfillment of the requirement for the award of degree of Master of Pharmacy

(Pharmaceutics)

Session 2022-2023



#### Supervisor:

Dr. Sunil K. Jain

M. Pharm., Ph.D.

Associate Professor

(Pharmaceutics)

#### Submitted By:

Jayshree

M. Pharm. 4th Sem

Enroll.: GGV/17/6220

Roll. No. 21072108

(Pharmaceutics)

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

#### DISSERTATION

ON

## TARGETED SURFACE MODIFIED NANOCARRIERS OF AN ANTI-CANCER DRUG FOR GASTRIC CANCER

Submitted for

Partial fulfillment of the requirement for the award of degree of Master of Pharmacy
(Pharmaceutics)

Session 2022-2023



#### Supervisor:

Dr. Sunil K. Jain

M. Pharm., Ph.D.

**Associate Professor** 

(Pharmaceutics)

#### Submitted By:

**Jayshree** 

M. Pharm. 4th Sem

Enroll.: GGV/17/6220

Roll. No. 21072108

(Pharmaceutics)

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

#### DEPARTMENT OF PHARMACY



[A Central University Established by the Central Universities ACT 2009 No. 25 of 2009]

Phone: 07752 - 260342, 260381, Website: www.ggu.ac.in, Fax: 07752-260148, 260154

Date		
------	--	--

### FORWARDING CERTIFICATE

This is to certify that Miss Jayshree student of M.Pharm. IV sem., Department of Pharmacy, Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G) has submitted her dissertation on the topic entitled "Targeted surface modified nanocarriers of an anti-cancer drug for gastric cancer" for the effective fulfillment of the requirement for the Degree of Master of Pharmacy (Pharmaceutics) with her truly and honesty observed inferences during her project work under the supervision of Dr. Sunil K. Jain. Her work is original, satisfactory and not submitted anywhere else for the award of any degree.

I hereby forward the dissertation to the Vishwavidyalaya for the Award of Degree of Master of Pharmacy (Pharmaceutics) for session 2022-2023.

Forwarded By:

(Head of Department)

Head

Department of Pharmacy
Guru Ghasidas Vishwavidyalaya
(A Central University)
Bilasnur (C.G.)

# **CONTENTS**

- Certificates I.
- II. Declaration
- Acknowledgement III.
- List of tables IV.
- V. List of figures
- VI. List of abbreviation
- VII. List of symbols

Chapter No.	Title	Page No.
1.	Introduction	1-33
	Gastric cancer	2-3
	<ul> <li>Types of stomach cancer</li> </ul>	4-5
	Gastric cancer risk factors	5-7
	<ul> <li>Different stages of gastric cancer</li> </ul>	7-8
	<ul> <li>Signs and symptoms</li> </ul>	8-9
	• Diagnosis	9-10
	• Treatment	10-14
	Drug carrier	15-20
	Literature survey	21-24
	Research envisaged	25-26
	Plan of work	27
	• References	28-33
2.	Drug and polymer profile	34-42
	Drug profile of oxaliplatin	34-36
	Polymer profile	37-40
	References	41-42
3.	Preformulation study	43-49
	Identification of drug	43
	Physical properties	43
	Melting point	43
	Solubility studies	43
	Partition coefficient of drug	44-45
	UV- spectroscopy	45-46
	• FTIR analysis	47
	Result and discussion	48
	References	49
4.	Formulation and characterization	50-73

	Materials	50-51
	Preparation method	51-52
	Optimization	52-55
	Characterization of chitosan	55-67
	nanoparticles	
	Result and discussion	68-71
	• References	72-73
5.	In vitro cytotoxicity study	73-77
	Result and discussion	77
6.	Summary and conclusion	78-82

DISSERTATION

On

# SURFACE-MODIFIED NANOCARRIERS OF AN ANTICANCER DRUG FOR ENHANCING COLORECTAL CANCER TARGETTING

Submitted for

Partial fulfilment of the requirement for the award of degree of

Master of Pharmacy (Pharmaceutics)

Session 2022-2023



SUPERVISOR

SUBMITTED BY

Dr. Sunil K. Jain

(M. Pharm, Ph.D.)

Associate Professor (Pharmaceutics)

KM. Pooja

M. Pharm 4th sem.

Roll No. 21082108

Enroll.: GGV/21/06355

A

#### DISSERTATION

On

# SURFACE-MODIFIED NANOCARRIERS OF AN ANTICANCER DRUG FOR ENHANCING COLORECTAL CANCER TARGETTING

Submitted for

Partial fulfilment of the requirement for the award of degree of

Master of Pharmacy (Pharmaceutics)

Session 2022-2023



**SUPERVISOR** 

SUBMITTED BY

Dr. Sunil K. Jain

KM. Pooja

(M. Pharm, Ph.D.)

M. Pharm 4th sem.

Associate Professor (Phanaceutics)

Roll No. 21082108

Enroll.: GGV/21/06355

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

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR [C.G.]

tral University Established by the Central Universities ACT 2009 No. 25 of 2009]

Phone: 07752 - 260342, 260381, Website: www.ggu.ac.in, Fax: 07752-260148, 260154

## FORWARDING CERTIFICATE

This is to certify tha Miss. KM. Pooja has submitted M. Pharm. Dissertation Synopsis entitled "Surface-modified nanocarriers of anticancer drug for enhancing colorectal targeting" for the partial fulfilment of the requirement for the Degree of Master of Pharmacy (Pharmaceutics) under the supervision Sunil K. Jain.

I hereby forward the Dissertation to the Vishwavidyalaya for the Award of Degree of Master of Pharmacy (Pharmaceutics) for session 2022-

Date:

Forwarded By

(Head of Department)

Head

Department of Phannacy
Guru Ghasidas Vishwavidyalaya
(A Central University)
Bilaspur (C.G.)

l, 11, 111,

Certificates

11	Destaut		
11.	Declaration		
111.	Acknowle	Total Control of the	
IV.	List of tal	les	
V.	List of fig	ures	
VI.	List of al	breviation	
Chapt	er no. T	tle	Page no.
,	I	troduction	1-16
		<ul> <li>Anatomy and physic</li> </ul>	ology 3-5
		<ul> <li>Colonic Barriers</li> </ul>	5-6
		<ul> <li>Growth of Colorecta</li> </ul>	al Cancer 6-7
		<ul> <li>Stages of colon cane</li> </ul>	
		<ul> <li>Colorectal Cancer S</li> </ul>	
		Symptoms	
		<ul> <li>Liagnostic and stage</li> </ul>	ing 8-9
		procedures for color	All and the second seco
		cancer	
		<ul> <li>Drugs Employed for</li> </ul>	r Colon 9-10
		Cancer	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		<ul> <li>Treatment Approach</li> </ul>	hes for 10-11
		CRC	
		<ul> <li>Surface modification</li> </ul>	on 11-12
		Chitosan	12-13
		<ul> <li>Cytotoxic drug (Pac</li> </ul>	
tracerer recent	e e e e e e e e e e e e e e e e e e e	■ Iv echanism of colo	
		targeting	
		<ul> <li>Literature survey</li> </ul>	17-23
		<ul> <li>Research envisaged</li> </ul>	d 24-25
		<ul><li>Plan of work</li></ul>	25-26
		<ul> <li>References</li> </ul>	27-39
2.		Drug and excipient prof	
		<ul> <li>Drug profile of pace</li> </ul>	elitaxel 41-43
		<ul> <li>Excipient profile</li> </ul>	. 43-46
2		• References	47
3.		Pre-formulation study	48-60
		<ul> <li>Solubility of paclit</li> </ul>	
		<ul> <li>Physical properties</li> <li>Molting point</li> </ul>	
Art (Chicago State)		<ul> <li>Melting point</li> </ul>	49

38

# FORMULATION AND CHARACTERISATION OF MULTI-PARTICULATE SYSTEM USING COMBINATION THERAPY FOR HEMORRHOIDS

THESIS

SUBMITTED FOR

PARTIAL FULFILMENT OF THE REQUIRMENT FOR THE AWARD OF THE

DEGREE OF

**MASTER OF PHARMACY** 

(PHARMACEUTICS)

(SESSION 2021-23)

IN THE SCHOOL OF STUDIES OF NATURAL RESOURCES

TO

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)

(A Central University Established by Central Universities Act., 2009 NO.25 of 2009)



BY

MANISH RABBERT KOSHLE

Under the supervision

Dr. ALPANA RAM
PROFESSOR (PHARMACEUTICS)

Department of Pharmecy

Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur (C.G.)

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

# FORMULATION AND CHARACTERISATION OF MULTI-PARTICULATE SYSTEM USING COMBINATION THERAPY FOR HEMORRHOIDS

A

THESIS

SUBMITTED FOR

PARTIAL FULFILMENT OF THE REQUIRMENT FOR THE AWARD OF THE

DEGREE OF

MASTER OF PHARMACY

(PHARMACEUTICS)

(SESSION 2021-23)

IN THE SCHOOL OF STUDIES OF NATURAL RESOURCES

TO

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)

(A Central University Established by Central Universities Act., 2009 NO.25 of 2009)



BY

MANISH RABBERT KOSHLE

Under the supervision

Dr. ALPANA RAM

**PROFESSOR (PHARMACEUTICS)** 

**Department of Pharmecy** 

Guru Ghasidas Vishwavidyalaya (A Central University), Bilaspur (C.G.)

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



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

(A Central University Established by Central Universities Act., 2009 No.25 of 2009)
Tel:+91-7752260027 (O); +91-8827989653 (Mob); Fax +91-7752-260148

#### FORWARDING CERTIFICATE

This is to certify that this dissertation work entitled "Foamulation and Characterisation of Multiparticulate System Using Combination Therapy for Hemorrhoids" work done by Mr. MANISH RABBERT KOSHLE student of m pharm. IV semester (pharamceutics) of this institute has submitted his dissertation under the supervision and guidance of Dr. Alpana Ram Professor (pharmaceutics), in the partial fulfillment of the requirement for thr award of Degree of Master of Pharmacy in Pharmaceutics.

I hereby forward his Dissertation for the award of M. Pharmacy (Pharmaceutics) during the academic session 2021-23.

Swy

Professor Bharti Ahirwar

(H.OID)d

Department of Pharmacy
Gurn Ghasidas Vishwavidyalaya
(A Central University)

Bilaspur (C.G.)

	CHAPTER-1	
1	INTRODUCTION	1
1.1	History of hemorrhoid	1
STATE OF THE PARTY	Types of hemorrhoid	2
1.2	Hemorrhoids can be caused by a variety of factords, including	2-3
1.3	Oral drug delivery system	3
1.4	Advantages of oral drug delivery	4
1.5	Disadvantages of oral drug delivery	5
1.6	Multiparticulate system of drug delivery	5-6
1.7	Multiparticulate system of drug derivery	6
1.8	Advantages of Multiparticulate System	6-7
1.9	Hard gelatin Capsule	8
1.10	Wet granules	8-9
1.11	Rectal	9
1.12	Anatomy of rectal  Where is the rectum	9
1.12.1	How long is the rectum	9-10
1.12.2		10
1.12.3	What are the part of rectum  Condition and disorder	10
1.12.4		10
1.13	Hemorrhoids	10-11
1.14	Pathophysiology of hemorrhoids	12
1.15	Treatment of hemorrhoids	12-13
1.16	Here are some home remedies for hemorrhoids	13-14
1.17	Management of hemorrhoides by Ayurveda	13-14
1.18	Management of hemorrhoides by allopathy	14-15
1.19	Myth's about hemorrhoids	14-13
	CHAPTER-2	16
2	LITERATURE REVIEW	19
2.1	Research Envisage	19
	CHAPTER-3 DRUG PROFILE	
3	CALCIUM DOBESILATE	21
3.1.1	Mechanism of action	21
3.1.2	Absorption	21
3.1.3	Biological half life	21
3.1.4	Metabolism	22
3.1.5	Rout of administration	22
3.1.6	Route of elimination	22
3.1.7	Half life	22
3.1.8	Drug interactions	22
3.1.9	Side effects	22-23
3.1.10	Medical uses	23
3.2	Plant profile	24
3.2.1	BITTER GOURD	24
3.2.2	Geographical sources	24
3.2.3	Morphological description	24

3.6.4	Methodology for herbal drug Preparation and Characterization of calcium dobesilate co-crystal	35
3.6.3	Preformulation studies	34
3.6.2	Selection of Drug and other excipients	34
3.6.1	Review of literature	34
3.6	PLAN OF WORK	34
3.5.7.6	Incompatibilities	33
3.5.7.5	Stability and storage	33
3.5.7.4	Solubility	33
3.5.7.3	Moisture content	33
3.5.7.2	Glass transition temperature	33
3.5.7.1	Density (bulk)	33
3.5.7	Typical Properties	33
3.5.6	Applications in Pharmaceutical Formulation or Technology	31-33
3.5.5	Functional Category	31
3.5.4	Empirical Formula and Molecular Weight	31
3.5.3	Chemical Name and CAS Registry Number	31
3.5.2	Synonyms	31
3.5.1	Nonproprietary Names	31
3.5	Ethyl Cellulose	31
3.4.8.8	Handling precautions	31
3.4.8.7	Safety	30
3.4.8.6	Incompatibilities	30
3.4.8.5	Stability and storage conditions	30
3.4.8.4	Solubility	29
3.4.8.2	Moisture content	29
3.4.8.1	Melting point	29
3.4.8	Acidity/alkalinity	29
3.4.7	Typical Properties	29
3.4.6	Applications in Pharmaceutical Formulation or Technology	28-29
3.4.5	Functional Category	28
3.4.4	Empirical Formula and Molecular Weight	27-28
3.4.3	Chemical Name and CAS RegistryNumber	27
3.4.2	Synonyms	27
3.4.1	Nonproprietary Names	27
3.4	HPMC	27
3.3.4	POLYMER PROFILE	27
3.3.3	Cultivation and collection	26-27
3.3.2	Cultivation and collection	26
3.3.1	Morphological description	26
3.3	Geographical sources	26
3.2.6	Synonyms	26
3.2.5	Biological activity	25
3.2.4	Phyto-constituents Phyto-constituents	25

3.6.6	Preparation of multi-particulate system of	35
3.6.7	Optimization of formulation	35
3.6.8	Characterization of optimized multi-particulate system	35
3.6.9	In-vitro drug release	36
3.6.10	In-vivo studies	36
3.6.11	Compilation	36
5.0.11	CHAPTER-4 PRE-FORMULATION STUDIES	
4	Preformulation	37
4.1	Organoleptic Properties	37
4.2	Melting Point	37
4.3	Capillary Melting Technique	37-38
4.4	Solubility studies	38
4.5	Partition coefficient	39-40
4.6	Micromertic studies	40
4.6.1	Determination of bulk and tapped density	40
4.6.2	Compressibility Indexand Hausner ratio	41
4.6.3	Angle of repose	41-42
4.6.4	Mcromertic properties of drugs	42
4.6.5	UV Spectroscopy	43
4.6.5.1	Spectral analysis	43
4.6.6	Photometric analysis	44
4.6.7	Preparation of calibration curve of Drug sample, Bitter Melon and	44-48
4.0.7	Ficus Religiosa	
4.6.8	FT-IR Spectral Assessment	48
4.6.9	Result and discussion	52-53
4.0.7	CHAPTER-5 FORMULATION AND OPTIMIZATION	
5	Formulation and Optimization	54
5.1	Factorial design	54
5.2	Regular three level three-factor	54
5.2.1	(2 <sup>3</sup> ) designs	54
5.3	Material and methods	54
5.3.1	Material	54
5.3.2	Methodology for herbal drug	54
5.3.2.1	Collection and preparation of fresh fruit and leaf	54
5.3.2.2	Authentication of the plant	55
5.3.2.3	Preparation of extract by Soxhlet method	55
5.4	Determination of flavonoid content	56-57
5.5	Drug Excipients Interaction Study by FTIR	58
5.6	Preparation of Calcium Dobesilate, Bitter Melon and Ficus	58-59
5.0	Religiosa extract granule	
5.7	Drug entrapment Efficiency	62
5.8	Micrometric Properties of Developed Formulation	63
.7 . 53	Bulk density and tapped density	63
5.8.1	Compressibility Index	64

5.8.4	Angle of Repose	64
5.8.5	Granule density	64
5.8.6	Material and equipment	65-66
5.8.7	Percentage yield%	68
5.9	Optimization	69
5.10	Characterization of optimized Multiparticulate system	70
5.10.1	Micromeritics studies	70
5.10.2	Bulk density and tapped density	70
5.10.2	Compressibility index	70
5.10.3	Angle of repose	70
	Granule density	71
5.10.5	Percentage yield	71
5.10.6	Particle size determination	71-72
5.10.7	Drug Interaction Study	75
5.11	FTIR studies of Optimized Formulation	75-76
5.11.1	In Vitro Drug Release Profile Of Combination Formulation	77
5.12	(F1,F1and F5)	
5.13	Assessment of Release Profile of Optimized Formulation	80-81
5.14	First order model	81
5.15	Higuchi-matrix model	81
5.16	Korsmeyer-Peppas model	82
5.17	RESULTS AND DISCUSSION	84-88
5.17	CHAPTER-6 IN VIVO STUDY	
6	IN VIVO STUDY	89
6.1	Animal protocol	89
6.2	Animal protection	89
6.3	Induction of Hemorrhoids and Selection of dose	89-90
6.4	Hematological parameters analysis	91
6.5	Estimation of Haemoglobin	91
6.6	Estimation of RBC Count	91
6.7	Estimation of WBC count	91
6.8	After the treatment of hemorrhoids rectal Section for Histology	93
6.9	Histopathological	94-95
6.10	Result and discussion	95-96
6.11	Histopathological evaluation	96
6.12	Induce hemorrhoids	96-99
6.13	Conclusion	100
7	References	101-107

DISSERTATION ON

"DEVELOPMENT AND CHARACTERIZATION OF GREEN TEA. CATECHIN LOADED EMULGEL FOR TREATMENT OF CHEMOTHERAPY INDUCED ALOPECIA"

Submitted for the partial fulfillment of the requirement for The Award of Degree of MASTER OF PHARMACY (PHARMACEUTICS)



2022-2023

Supervised by DR. RAVI SHANKAR PANDEY M.PHARM., Ph.D. PROFESSOR

EN SIDDIQUI

DEPARTMENT OF PHARMACY, GURU GHASIDAS

VISHWAVIDYALAYA, BILASPUR (C.G.) 495009

Abid Printer9770398993



A

#### DISSERTATION

ON

"DEVELOPMENT AND CHARACTERIZATION OF GREEN TEA CATECHIN LOADED EMULGEL FOR TREATMENT OF CHEMOTHERAPY INDUCED ALOPECIA"

Submitted for the partial fulfillment of the requirement for

The Award of Degree of

**MASTER OF PHARMACY** 

(PHARMACEUTICS)



#### Supervised by

DR. RAVI SHANKAR PANDEY M.PHARM., Ph.D. PROFESSOR

#### Submitted by

NISHAT PARVEEN SIDDIQUI M.PHARM IV SEM PHARMACEUTICS Enroll No. GGV/17/6252 Roll No. 21082110

DEPARTMENT OF PHARMACY, GURU GHASIDAS

VISHWAVIDYALAYA, BILASPUR (C.G.) 495009



### DEPARTMENT OF PHARMACY, GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.), 495009

(A Central University Established by the Central University Act-2009 No-25 of 2009) Tel.No.07752-260027; FaxNo.07752-260148.

### FORWARDING CERTIFICATE

This is to certify that Miss NISHAT PARVEEN SIDDIQUI M. Pharm IV semester (Pharmaceutics) of this institute has submitted her dissertation work entitled "DEVELOPMENT AND CHARACTERIZATION OF GREEN TEA CATECHIN LOADED EMULGEL FOR TREATMENT OF CHEMOTHERAPY INDUCED ALOPECIA" for the partial fulfilment of the requirement for the award of degree of Master of Pharmacy (Pharmaceutics) with her truly and honestly observed inference during her research work under the supervision of DR. RAVI SHANKAR PANDEY. Her work is original, satisfactory and is not submitted anywhere else for the award of any degree.

I hereby forward her dissertation for the award of M. Pharm. degree in Pharmaceutics during the academic session 2022-2023.

HEAD OF DEPARTMENT

Head

Department of Pharmacy

Guru Chasidas Vishwavid; Jaya

(A Central University)

Bilashus (C.C.)

# LIST OF CHAPTERS

S.NO	CHAPTERS	PAGE NO.
	1. INTRODUCTION	TAGETIO
1.1	The hair growth cycle	1-2
1.2	Types of alopecia	2
1.2.1	Chemotherapy induced alopecia	2
1.2.1.2	Types of chemotherapy indscued alopecia	3-4
1.3	Pathogenesis of chemotherapy induced alopecia	
1.4	Chemotherapy induced alopecia	5
1.5	Topical delivery system	
1.6	Emulgel	5-6
1.7	Epigallocatechin Gallate	6-7
1.8		7
	Different types of strategy for prevention and treatment of chemotherapy induced alopecia	8-11
1.8.1	Physical approach	8-9
1.8.1.1	Scalp cooling method	8-9
1.8.2	Therapeutic approach	8-11
1.8.2.1	Topical/oral minoxidil	9-10
1.8.2.2	Topical/Systemic calcitriol	10
1.8.2.3	Prostaglandin analogue	10
1.8.2.4	Topical epinephrine or norepinephrine	10-11
1.9	Literature survey	12-13
1.10	Research Envisaged	13
1.11	Plan of work	14
	Reference	15-17
	2. DRUG EXCIPIENT PROFILE	
2.1	Epigallocatechin Gallate	18
2.1.1	Physical properties	18
2.1.2	Mechanism of action	18
2.2	Selection of excipient for formulation development	19-21
2.2.1	Selection of oil phase	19

2.2.2	Selection of surfactants	19
2.2.3	Determination of RHLB value for oil phase	19-20
2.2.4	Selection of gelling agents	21
2.3	Carbopol 934	21
2.4	Tween 80	21-22
2.5	Span 80	22-23
2.6	Olive oil	23
	Reference	24
	3. PREFORMULATION	
3.1	Material	25
3.2	Methods	25
3.2.1	Physical/morphological evaluation of drug	25
3.2.2	Solubility study	25
3.2.3	Partition coefficient determination	25-26
3.2.4	UV-Spectroscopy study	26
3.2.4.1	UV- Determination of λ max	26
3.2.4.1.1	Preparation of standard curve EGCG	26
3.2.5	FTIR spectroscopy study	26
3.3	RESULT AND DISCUSSION	
3.3.1	Physical/ morphological evaluation of drug	27
3.3.2	Solubility study	27
3.3.3	Partition coefficient	27-28
3.3.4	UV-Spectroscopy study	28-31
3.3.5	Identification by FTIR spectroscopy	32-33
	Result and discussion	34
	Reference	35
4. F	ORMULATION, OPTIMIZATION AND CHARACTERI	ZATION
1.1	Construction of pseudo ternary phase diagram	36
4.2	Method preparation, optimization and characterization	37
4.2.1	Method preparation	37-38
4.2.2	Optimization of drug loaded emulgel	39

4.2.3	Characterization of optimized formulation	40-44
4.3	RESULT AND DISCUSSION	10 /1
4.3	Construction of pseudo ternary phase diagram	45
4.3.1	Preparation, optimization and characterization of formulation	45-67
	Conclusion	68
	Reference	69-70
	5. BIOLOGICAL EVALUATION	
5.1	Animal and method	71
5.1.2	Experimental approval and design	71
5.1.4	Chemical and other material	71
5.1.5	Methods	
5.1.6	In vitro skin permeation and drug deposition study	72
5.1.7	Development of chemotherapy induced alopecia animal study	72-73
5.1.8	Morphological changes	73
5.1.9	Histopathological analysis	73
5.1.10	Bioanalytical method for estimation of EGCG	73
5.1.11	Determination of hair diameter and length	73
5.1.12	Statistical Analysis	74
5.2	RESULT AND DISCUSSION	
5.2.1	In vitro skin permeation study	75
5.2.2	Development of chemotherapy induced alopecia	76
5.2.3	Determination of hair diameter and length	76-78
5.2.4	Histopathological Analysis	78-79
5.2.5	Determination of drug presence in blood sample	80-81
	Reference	83
	6.SUMMARY AND CONCLUSION	
6	Summary and conclusion	84-87

# DISSERTATION

D)N

FORMULATION AND CHARACTERISATION OF MULTI-PARTICULATE
SYSTEM OF PROTON PUMP INHIBITOR USING A COMBINATION
THERAPY FOR PEPTIC ULCER

Submitted for the Partial fulfillment of the requirement for

The Award of Degree of MASTER OF PHARMACY

(PHARMACEUTICS)

Session 2022-2023



Submitted By

PRINCE NIKHIL RATHORE

M.Pharm 4th Semester

(Pharmaceutics)

Roll no: 21082111

Enr.No: GGV/17/6261

Supervisor

Prof.(Dr.) ALPANA RAM

M.Pharm., Phd.

(Pharmaceutics)

Department of Pharmacy

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

Abid Printer 9770396993BSI

#### GURU GHASIDAS VISHWAVIDYALAYA, KONI, BILASPUR(C.G)

( A Central University Established by the Central University Act-2009 No-25 of 2009)

Tel. No. 07752-260027; Fax No. 07752-260148

#### FORWARDING CERTIFICATE

This is to certify that Mr. PRINCE NIKHIL RATHORE M.Pharm 4<sup>th</sup> semester (Pharmaceutics) of this institute has submitted his dissertation work entitled "FORMULATION AND CHARACTERISATION OF MULTI- PARTICULATE SYSTEM OF PROTON PUMP INHIBITOR USING A COMBINATION THERAPY FOR PEPTIC ULCER" for the partial fulfillment of the requirement for the award of the degree of Master of Pharmacy (Pharmaceutics) with his truly and honestly observed inference during his research work under the supervision of Prof. (Dr.)Alpana Ram. His work is original, satisfactory, and not submitted anywhere else for the award of any degree.

I hereby forward his dissertation work for the M.Pharm degree in Pharmaceutics award during the academic session 2022-2023.

Date:

Place: Bilaspur

Forwarded By:

**Head Of Department** 

Head
Department of Pharmacy
Guru Ghasidas Vishwavidyalaya
(A Central University)

Bilaspur (C.G.)



#### GURU GHASIDAS VISHWAVIDYALAYA, KONI, BILASPUR(C.G)

( A Central University Established by the Central University Act-2009 No-25 of 2009) Tel. No. 07752-260027; Fax No. 07752-260148

#### CERTIFICATE

This is to certify that Mr. PRINCE NIKHIL RATHORE S/O Shri. Umashankar Rathore M.Pharm 4th semester (Pharmaceutics) of this institute has submitted his dissertation work entitled "FORMULATION AND CHARACTERISATION OF MULTI-PARTICULATE SYSTEM OF PROTON PUMP INHIBITOR USING A COMBINATION THERAPY FOR PEPTIC ULCER" for the partial fulfillment of the requirement for the award of the degree of Master of Pharmacy (Pharmaceutics) with his truly and honestly observed inference during his research work. He has completed his project work under my guidance. His work is original, satisfactory, and not submitted anywhere else for the award of any degree.

I hereby forward his dissertation work for the M.Pharm degree in Pharmaceutics award during the academic session 2022-2023.

24.11.2023 Date:

Place: Bilaspur

Supervisor Prof.( Dr.)Alpna Ram (Pharmaceutics) Department of Pharmacy G.G.V. Bilaspur (C.G)

CHAPTER 1 INTRODUCTION				
SECTION	TITLE	PAGE NO.		
1.1	Oral drug delivery form	1-2		
1.2	Sustained drug release	2		
1.2.1	Classification of Sustained release system	3		
1.2.2	Coating-Sustained Delivery Systems	3-4		
1.2.3	Advantages of Sustained/Controlled Release System	4		
1.2.4	Disadvantage of Sustained/Controlled Release System	4-5		
1.3	Multiparticulate System Of Drug Delivery	5-6		
1.3.1	Advantages of Multiparticulate System	6		
1.4	Pharmaceutical Co-Crystal	7		
1.4.1	Solvent Evaporation Technique	7		
1.5	Enteric-coated Capsule	8-9		
1.5.1	Enteric-coated Granules	9-11		
1.6	Gastrointestinal Tract: Anatomy	11		
1.6.1	Anatomical features of stomach	11		
1.6.1.1	Anatomical Position	11		
1.6.1.2	Structure	11-12		
1.6.1.3	Sections	12		
1.6.2	Anatomical Features of Small Intestine	13		
1.6.2.1	Size and division	13		
1.6.3	Large Intestine	13-14		
1.6.3.1	Structure	14		
1.6.3.2	Sections	14-15		
1.6.4	pH of drug delivery	15		
1.6.5	Gastrointestinal transit time	16		
1.7	Peptic Ulcer Disease	16		

1.7.1	Types of Peptic Ulcer	16
1.7.1.1	Duodenal Ulcer	16-17
1.7.1.2	Gastric Ulcer	17
1.7.1.3	Epidemiology	17
1.7.2	Cause of Peptic Ulcer	17
1.7.2.1	Abnormal mucous secretion	17
1.7.2.2	Alteration in the Secretion of Bicarbonate	17-18
1.7.2.3	Reduction in Gastric Mucosal Bloof Flow	18
1.7.2.4	Helicobacter pylori	18
1.7.2.5	Non-steroidal anti-inflammatory drugs	18
1.7.2.6	Cigarette Smoking	19
1.7.2.7	Psychological Factors and Stress	19
1.8	Symptoms of Peptic ulcer	19-20
1.9	Pathophysiology	20-21
1.10	Diagnosis of Peptic ulcer	21
1.11	Management of Peptic ulcer	21-23
1.12	Management of Peptic ulcer by Ayurveda	23
1.12.1	Emblica Officinalis's Ulcer-Preventive Properties	23
1.12.2	Biopotentiation of drugs using herbal options	23-24
3325	Francisco Company	340
9.3.2 A	CHAPTER 2 LITERATURE REVIEW	30-31
2	Literature Review	25-29
2.1	Research Envisaged	30-31
	CHAPTER 3 DRUG PROFILE	No.
3	Drug and Excipient Profile	32
3.1	Esomeprazole Magnesium	32-34
3.2	Amla	35-36
3.3	Polymer Profile	37

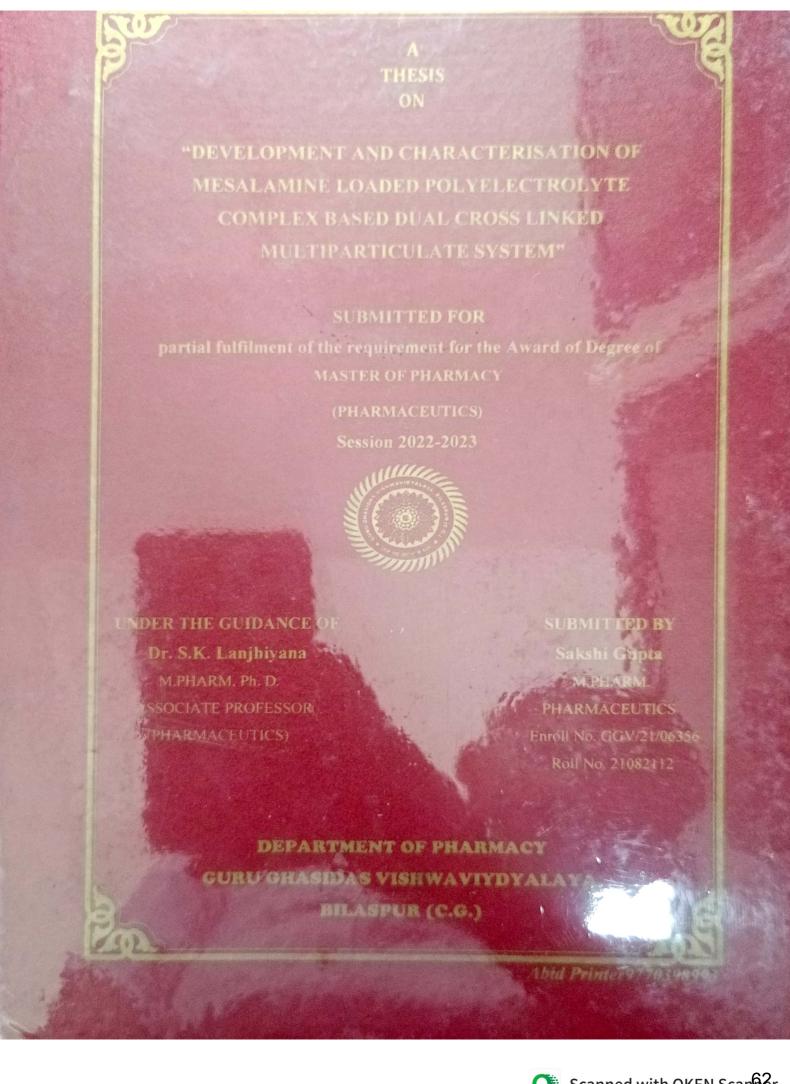
3.3.1	HPMC	37
3.3.1.1	Nonproprietary Names	37
3.3.1.2	Synonyms	37
3.3.1.3	Chemical Name and CAS Registry Number	37
3.3.1.4	Empirical Formula and Molecular Weight	37
3.3.1.5	Functional Category	37
3.3.1.6	Applications in Pharmaceutical Formulation or	37-38
	technology	1.
3.3.1.7	Description	38
3.3.1.8	Typical Properties	38
3.3.1.9	Stability and Storage Conditions	38-39
3.3.1.10	Incompatibilities	39
3.3.1.11	Safety	39
3.3.1.12	Handling Precautions	39
3.3.2	Ethylcellulose	40
3.3.2.1	Nonproprietary Names	40
3.3.2.2	Synonyms	40
3.3.2.3	Chemical Name and CAS Registry Number	40
3.3.2.4	Empirical Formula and Molecular Weight	40
3.3.2.5	Functional Category	40
3.3.2.6	Applications in Pharmaceutical Formulation or	40-41
	technology	30.52
3.3.2.7	Typical Properties	41
3.3.2.8	Stability and Storage	41
3.3.2.9	Incompatibilities	41
3.3.3	HPMC P	42
3.3.3.1	Nonproprietary	42
3.3.3.2	Synonyms	42

		10
3.3.3.3	Chemical Name and CAS Registry Number	42
3.3.3.4	Empirical Formula and Molecular weight	42
3.3.3.5	Functional Category	42
3.3.3.6	Applications in Pharmaceutical or technology	42-43
3.3.3.7	Description	43
3.3.3.8	Typical Properties	43
3.3.3.9	Stability and Storage Conditions	43
3.3.3.10	Incompatibilities	43
3.4	Plan of work	44-45
5224	CHAPTER 4 PREFORMULATION	(1)-(1)
4	Preformulation	46
4.1	Organoleptic Properties	46
4.2	Melting Point	46
4.2.1	Capillary Melting Technique	46
4.3	Solubility Study	47
4.4	Partition Coefficient	47-48
4.5	Micromeritic Studies	48
4.5.1	Determination of Bulk Density and Tapped Density	48
4.5.2	Compressibility Index and Hausner ratio	49
4.5.3	Angle of Repose	49-50
4.6	UV Spectroscopy	50
4.6.1	Spectral analysis	50-52
4.6.2	Photometric Analysis	52
4.6.2.1	Preparation of calibration Drug sample and Amla extract	53-56
4.7	FTIR Spectral Assessment	56-59
4.8	X-Ray Diffraction Method	59-60
273	taxiro dog miraso andes	
	CHAPTER 5 FORMULATION AND OPTIMIZATION	

		1
5	Formulation and Optimization	64
5.1	Factorial Design	64
5.1.1	Regular two-level and three-factor	64
5.2	Materials and Methods	64
5.2.1	Material	64
5.2.2	Methodology for Herbal Drug	64
5.2.2.1	Collection and Preparation of Dried Powder	64-65
5.2.2.2	Authentication of the plant	65
5.2.2.3	Preparation of extract by Soxhlet method	65
5.2.2.4	Determination of Phenolic content	65-66
5.2.2.5	Preparation of Standard gallic acid	66
5.2.2.6	Reagent preparation	66-67
5.2.3	Preparation of Esomeprazole Magnesium co-crystal	67-68
5.2.4	Characterization of Esomeprazole Magnesium co-crystal	68
5.2.4.1	FTIR study	68
5.2.4.2	Scanning Electron Microscopy	69
5.2.4.3	X-Ray Diffraction	69-70
5.2.5	Drug Excipients Interaction Study	70
5.2.5.1	Drug Excipients Interaction Study	70
5.2.5.2	X-ray diffraction Study of Drug and Polymer Physical	70-71
	Mixture	
5.2.6	Preparation of Esomeprazole Magnesium and Amla	71-72
	extract granule	98
5.2.7	Method of Preparation of Coating Solution	72
5.3	Characterisation of Developed Formulation	75
5.3.1	Drug entrapment efficiency	75
5.3.2	In vitro drug release studies	76-79
5.3.3	Micromeritic Properties of Developed Formulation	79
THE RESERVE OF THE PARTY OF THE		

5.3.3.1	Bulk density and Tapped density	79
5.3.3.2	Compressibility Index	79-80
5.3.3.3	Hausner's ratio	80
5.3.3.4	Angle of Repose	80
5.3.3.5	Granule density	80-81
5.3.3.6	Percentage yield %	81-82
5.4	Optimization	82-83
5.5	Characterization of Optimized Multiparticulate System	83
5.5.1	Micromeritic Studies	83
5.5.1.1	Determination of Bulk Density and Tapped Density of	83
	granule	197
5.5.1.2	Carr's Index and Hausner Ratio	83
5.5.1.3	Angle of repose	83
5.5.1.4	Granule density	84
5.5.1.5	Percentage yield %	84
5.5.1.6	Particle Size Determination	84-87
5.5.1.7	Scanning Electron Microscopy	87-90
5.5.2	Drug Interaction Study	90
5.5.2.1	FTIR studies of Optimized Formulation	90-91
5.5.2.2	X-Ray Diffraction study	91-92
5.5.3	In vitro Drug Release Profile of Combination	92-94
	Formulation	
5.5.4	Assessment of Release Profile of Optimized Formulation	94
5.5.4.1	Zero-order model	94-95
5.5.4.2	First-order model	95
5.5.4.3	Higuchi-matrix model	95
5.5.4.4	Hixson- Crowell model	95-96
5.5.4.5	Korsmeyer-Peppas model	96-99

	CHAPTER 6 IN VIVO STUDY	
6	IN VIVO STUDY	104
6.1	Material and methods	104
6.1.1	Animals and ethics	104
6.1.2	Materials	104-105
6.1.3	Selection of dose and induction of acute peptic ulcer by	105-106
	aspirin	
6.2	Estimating the ulcer index along with a macroscopic	106
	evaluation	
6.3	Estimation of gastric juice acidity	107
6.4	Hematological parameters analysis	107
6.4.1	Estimation of Haemoglobin	107
6.4.2	Estimation of RBC count	107
6.4.3	Estimation of WBC count	107-108
6.4.4	Histopathological evaluation	109-110
6.4.5	Statistical analysis	110
6.4.6	% Drug concentration in blood of Prepared Formulation	110
	of Esomeprazole Magnesium	-8
		50
	and have all Hampersonic Magnesium in SOV (011-3.3).	-53
	CHAPTER 7 SUMMARY AND CONCLUSION	34
7	Summary and Conclusion	120-123
8	CHAPTER 8 BIBLIOGRAPHY	
	Bibliography	124-134



cA THESIS ON

# "DEVELOPMENT AND CHARACTERISATION OF MESALAMINE LOADED POLYELECTROLYTE COMPLEX BASED DUAL CROSS LINKED MULTI-PARTICULATE SYSTEM"

# SUBMITTED FOR

the partial fulfilment of the requirement for the Award of Degree of MASTER OF PHARMACY (PHARMACEUTICS)

Session 2022-2023



#### UNDER THE GUIDANCE OF

Dr. S.K. Lanjhiyana M.PHARM, Ph. D.

ASSOCIATE PROFESSOR (PHARMACEUTICS)

SUBMITTED BY

Sakshi Gupta

M.PHARM.

**PHARMACEUTICS** 

Enroll No. GGV/21/06356

Roll No. 21082112

DEPARTMENT OF PHARMACY
GURU GHASIDAS VISHWAVIYDYALAYA, BILASPUR
(C.G.)



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

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

Tel. No. 07752-260027; Fax No. 07752-260148

# FORWARDING CERTIFICATE

This is to certify that Ms. Sakshi Gupta D/O Mr. Om Prakash Gupta M.Pharm IV<sup>th</sup> semester (Pharmaceutics) of this institute has submitted her Thesis entitled "DEVELOPMENT AND CHARACTERISATION OF MESALAMINE LOADED POLYELECTROLYTE COMPLEX BASED DUAL CROSS LINKED MULTI - PARTICULATE SYSTEM" for the partial fulfilment of the requirement for the award of the degree of Master of Pharmacy (Pharmaceutics) with her truly and honestly observed inference during her research work under the supervision of Dr. S. K. Lanjhiyana. Her work is satisfactory and not submitted anywhere else for the award of any degree.

I hereby forward her Thesis for the M. Pharm degree in Pharmaceutics award during the academic session 2022-2023.

Date:

Place: Bilaspur

FORWARDEDBY:

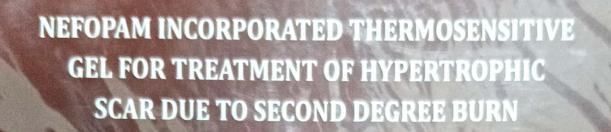
(Head of Department)

Head

Department of Pharmacy
Guru Ghasidas Vishwavidyalaya
(A Central University)
Bilaspur (C.G.)

	CHAPTER 1 INTRODUCTION	
SECTION	TITLE	PAGE NO.
1.1	Inflammatory Bowel Disease	1-8
1.2	Oral Drug Delivery System	8-20
1.3	Criteria for Selection of Drug for Colonic Drug Delivery	20
1.4	Approaches to prepare microbeads	20-23
1.5	Polyelectrolyte Complexes	23-25
1.6	Multiparticulate System	25-26
1.7	Research Envisaged	26-27
1.8	Plan of Work	28-29
	CHAPTER 2 LITERATURE REVIEW	
2.1	LITERATURE REVIEW	30-34
	CHAPTER 3 DRUG AND EXCIPIENT PROFILE	
3.1	DRUG AND EXCIPIENT PROFILE	
3.1.1	Mesalamine	35-38
3.1.2	Chitosan	39-40
3.1.3	Sodium Alginate	41-42
	CHAPTER 4 PREFORMULATION STUDY	
4.1	Material used in study	43
4.2	Equipment used in study	43
4.3	Identification of drug and excipients	44-56
4.4	Result & Discussion	57-58
CHA	APTER 5 FORMULATION AND CHARACTERIZATION	ON 50.62
5.1	Formulation of Microbead	59-62
5.2	Characterization	62
5.2.1	Particle size distribution Shape and Surface Morphology	63-65
5.2.2	Determination of drug entrapment efficiency and	65-67
5.2.3	percentage yield	•
5.2.4	Swelling index	68
5.2.5	In vitro drug release	69-79
5.2.6	Drug-drug interaction and drug-polymer interaction	79-81
5.3	Result & Discussion	82-84
	CHAPTER 6 STABILITY STUDY	95.00
6.1	Stability study	85-90

6.2 Result & Discussion		91	
7.1 CHAPTER 7 IN VIVO STUDY Method Result & Discussion		92 <b>-</b> 95 96	
CHAPTER 8 SUMMARY & CONCLUS	SION	97-99	
CHAPTER 9 BIBLIOGRAPHY		100-109	
Description of the party of the			



A

Thesis

Submitted for Partial Fulfilment of the Requirement for the Award of Degree of

Master of Pharmacy
(Pharmaceutics)
(Session 2022-2023)

SUPERVISED BY
DR. MANOJ KUMAR
M.PHARM., PhD
Assistant Professor

SUBMITTED BY
SHIVANI TOMAR
M.PHARM. IV SEM
(Pharmaceutics)
Enroll No. GGV/21/06257
Roll. No. 21082113.

DEPARTMENT OF PHARMACY \\
GURU GHASIDAS VISHWAVIDYALAYA,
BILASPUR, CHHATTISGARH

# NEFOPAM INCORPORATED THERMOSENSITIVE GEL FOR TREATMENT OF HYPERTROPHIC SCAR DUE TO SECOND DEGREE BURN

A

#### Thesis

Submitted for Partial Fulfilment of the Requirement for the Award of Degree of

## **Master of Pharmacy (Pharmaceutics)**

(Session 2022-2023)



#### SUPERVISED BY

DR. MANOJ KUMAR M.PHARM., PhD Assistant Professor

#### SUBMITTED BY

SHIVANI TOMAR

M.III VIV SEM

(Pharma

Enroll No. Guardine Roll. No. 21082113

DEPARTMENT OF PHARMACY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR, CHHATTISGARH



GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.) (A central University Established by the Central University Act 2009 No. 25 of 2009)

Tel.:07752-260027 (O); Fax; 07752-260148

# FORWARDING CERTIFICATE

This is to certify that Ms. Shivani Tomar has submitted her thesis entitled "Nefopam Incorporated Thermosensitive Gel For Treatment of Hypertrophic Scar Caused by Second Degree Burns" for the partial fulfilment of the requirement for the degree of Master of Pharmacy (Pharmaceutics) under the supervision of Dr. Manoj Kumar (M. Pharm., PhD.).

I hereby forward her thesis to the Guru GhasidasVishwavidyalaya for the award of the degree of Master of Pharmacy (Pharmaceutics) for the session 2022-2023.

Date:

FORWARDED BY:

Head of Department

Department of Pharmacy Gurw Ghasidas Vishwavidyalaya (A Central University) Bilaspur (C.G.)

CHAPTERS	TITLE	PAGE.NO
Chapter 1	Introduction	1-22
1.1	Drug delivery system	2
1.1.1	Topical route of administration	2
1.1.2	Advantages of topical route of administration	2-3
1.2	Thermosensitive hydrogel	3-5
1.2.1	Mechanism of Thermosensitive Hydrogel from chitosan	5-6
1.2.2	Applications of chitosan forming Thermosensitive Hydrogel	6-7
1.3	Skin	8-9
1.3.1	Structure of skin	8-9
1.3.3	Functions of skin	9-10
1.4	Burns	10
1.4.1	Classification of burns on the basis of degree	10-11
1.5	Scarring	11-12
1.5.1	Hypertrophic Scar	12-13
1.6	Epidemiology	13
1.7	Pathophysiology of Hypertrophic scars	14
1.8	Etiology	14
1.9	Drawbacks of older methods	15
1.10	Prevention and Treatment methods	15-16
1.11	References	17-22
Chapter 2	Literature Review	23-31
Chapter 3	Research Envisaged and plan of work	32-35
3.1	Research Envisaged	33

DEPARTMENT OF PHARMACY, GGV, A CENTRAL UNIVERSITY, BILASPUR, C.G.

3.2	Objective	33
3.3	Plan of Work	34-35
Chapter 4	Drug and Excipients Profile	36-41
4.1	Characteristic Profile of Nefopam	37
4.2	Characteristic Profile of Chitosan	38
4.3	Characteristic Profile of Beta - Glycerophosphate	39
4.4	References	40-41
Chapter 5	Preformulation Study	42-54
5.	Preformulation studies	43
5.1	List of Materials	43
5.2	List of equipment	43
5.3	Method and process of analysis	44
5.4	Physicochemical and morphological Characterization of drug	44
5.4.1	Melting Point	44
5.4.2	Fourier Transform Infrared Spectroscopy Analysis	45
5.4.3	UV Spectroscopy analysis	45
5.4.4	Drug Excipients Compatibility	46
5.4.5	Chemical Characterization of drug	46
5.4.5.1	Solubility Study	46
5.4.5.2	Partition Coefficient	46
5.5	Result and Discussion	47
5.5.1	Identification and Characterization of drug	47
5.5.2	Melting Point	47
5.5.3	UV Spectral analysis	48
5.5.4	Linearity and Range	49

DEPARTMENT OF PHARMACY, GGV, A CENTRAL UNIVERSITY, BILASPUR, C.G.

5.5.5	Chemical Characterization of drug and Excipients	49-52
5.6	References	53-54
Chapter 6	Formulation Development and Characterization	55-79
6.1	Method of preparation of Thermosensitive gel	56
6.2	Component used in formulation	56
6.3	Formulation Development	57
6.3.1	Preparation of optimized formulation by DOE technique	57-58
6.4	Characterization of Thermosensitive gel system	59
6.4.1	Determination of gelation temperature	59
6.4.2	Determination of gelation time	59
6.4.3	Determination of Zeta potential	59
6.4.4	pH measurement	59
6.4.5	Evaluation of thermoreversible behaviour	59
6.4.6	Rheological study	59
6.4.7	Scanning electron microscopy	60
6.4.8	Transmission electron Microscopy	60
6.4.9	In vitro drug release study	60
6.4.10	Ex Vivo drug release study	60
6.4.11	1 Kinetic studies of result data	
6.5	Result and Discussion	61
6.5.1	Formulation development	61-77
6.5.2	Characterization of thermosensitive gel	62
6.5.2.1	Determination of gelation temperature	62
6.5.2.2	Determination of gelation time	63
6.5.2.3	Determination of Zeta potential	63

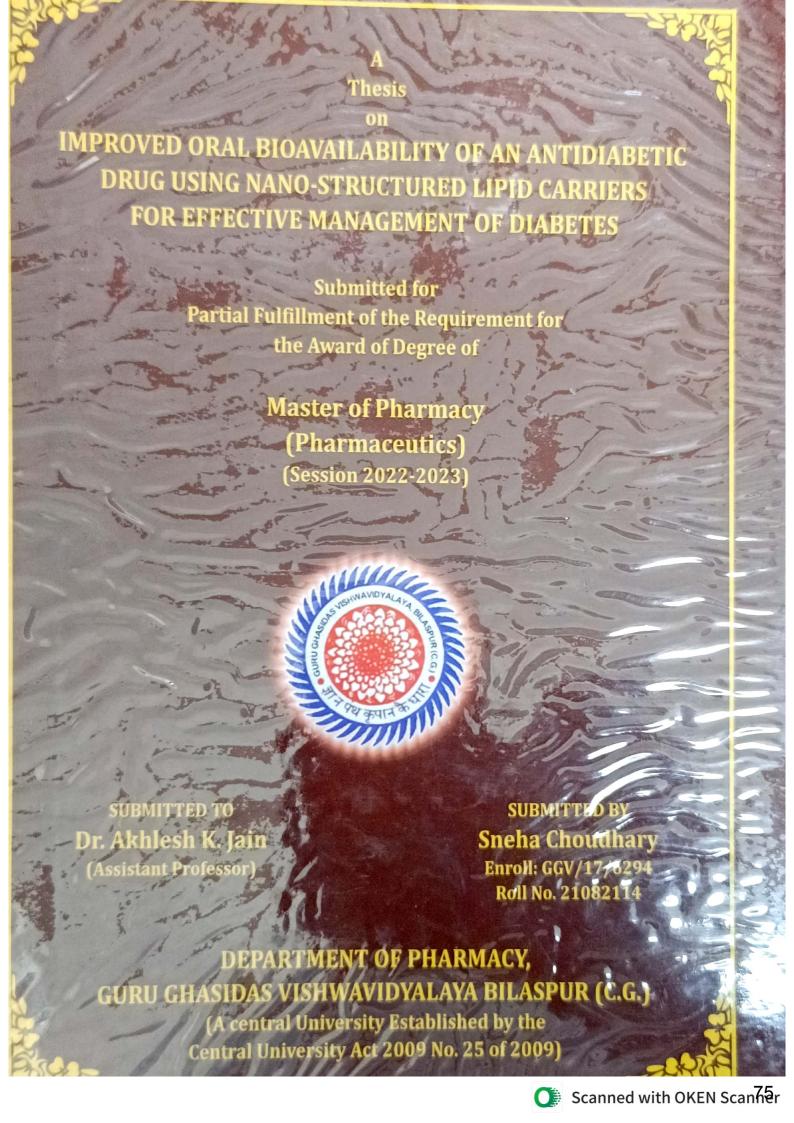
DEPARTMENT OF PHARMACY, GGV, A CENTRAL UNIVERSITY, BILASPUR, C.G.

6.5.2.4	pH measurement	
6.5.2.5	Evaluation of thermoreversible behaviour	
6.5.2.6	Rheological study	
6.5.2.7	Scanning electron microscopy	64-65
6.5.2.8	Transmission electron Microscopy	66
6.5.2.9	In vitro drug release study	66
6.5.2.10	Ex Vivo drug release study	78
6.5.2.11	Kinetic studies of result data	69-71
6.6	Optimization and Statstical data analysis	72
6.6.1	Effect on gelation temperature	72
6.6.2	Effect on gelation time	73
6.6.3	Effect on drug release	
6.7	References	
Chapter 7	In vivo study	
7.1	Animals	
7.2	Chemicals and other materials	
7.3	Experimental Protocol	
7.3.1	Rat skin irritation test by closed patch test	82
7.4	Second degree thermal burn experimental model	82
7.5	% wound Contraction	
7.6	Scar Model in the rats	
7.7	Histological analysis	
7.8	Bioanalytical method for estimation of NFH (Nefopam Hydrochloride)	
7.9	Result and Discussion	84-96
7.9.1	Result of rat skin irritation experiment	84

DEPARTMENT OF PHARMACY, GGV, A CENTRAL UNIVERSITY, BILASPUR, C.G.

7.9.2	Different stages of skin experiment effect	84	
7.9.3	Study of design and clinical evaluation	85	
7.9.4	Result of % wound contraction	89	
7.9.5	Result of Scar reduction	91	
7.9.6	Histological study	93-96	
7.10	Determination of drug presence in blood sample	97	
7.11	Conclusion	98	
7.12	References	99-100	
Chapter 8	Stability study	101-103	
8.1	Stability	102	
8.2	Objective and purpose	102	
8.3	Stability Study of optimized formulation	103	
8.4	Result and discussion	103	
8.5	References	103	

DEPARTMENT OF PHARMACY, GGV, A CENTRAL UNIVERSITY, BILASPUR, C.G.



A Thesis on

# IMPROVED ORAL BIOAVAILABILITY OF AN ANTIDIABETIC DRUG USING NANO-STRUCTURED LIPID CARRIERS FOR EFFECTIVE MANAGEMENT OF DIABETES

Submitted for

Partial Fulfillment of the Requirement for the Award of Degree of

Master of Pharmacy (Pharmaceutics)

(Session 2022-2023)



SUBMITTED TO

Dr. Akhlesh K. Jain (Assistant Professor)

SUBMITTED BY

Sneha Chou

Enroll: GGV/17

Roll No. 21082114

DEPARTMENT OF PHARMACY,

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

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



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

(A Central University Established by the Central University Act 2009 No. 25 of 2009) Tel.:07752-260027 (O); Fax; 07752-260148

#### FORWARDING CERTIFICATE

This is to certify that Miss Sneha Choudhary D/O Mr. Ravi Choudhary is a student of M. Pharm 4th Semester in Department of Pharmacy, Guru Ghasidas Vishwavidyalaya, Bilaspur has submitted her Project entitled "Improved Oral Bioavailability of An Antidiabetic Drug Using Nano-Structured Lipid Carriers for Effective Management of Diabetes" for the partial fulfillment of the requirement for the degree of Master of Pharmacy (Pharmaceutics) under the supervision of Dr. Akhlesh K. Jain (Assistant Professor).

I hereby forward her project in M. Pharmacy (Pharmaceutics) during the academic session 2022-2023.

Date: 02 12 23

Place: Bilospur

**Head of Department** Head

Department of Pharmacy Guru Ghasidas Vishwavidwalaya (A Central University) Bilaspur (C.G.)

## LIST OF CONTENTS

Chapter No.	Title	Page No.
1	INTRODUCTION	1-35
2	DRUG PROFILE	36-42
3	PRE-FORMULATION STUDY	43-49
4	FORMULATION AND CHARACTERIZATION	50-66
5	IN-VIVO STUDY	67-71
6	SUMMARY AND CONCLUSION	72-76
	REFERENCES	
	A. INTRODUCTION	28-35
	B. DRUG PROFILE	41-42
	C. PRE-FORMULATION STUDY	49
	D. FORMULATION AND CHARACTERIZATION	66
	E. IN-VIVO STUDY	71

## FORMULATION AND CHARACTERIZATION OF NYSTATIN LOADED CHITOSAN-GUAR GUM BASED NANOCAPSULES FOR THE EFFECTIVE TREATMENT OF FUNGAL KERATITIS

#### Dissertation

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

#### MASTER OF PHARMACY

(Pharmaceutics)



Session 2022-2023

#### SUPERVISOR

Dr. K. Kesavan

(M. Pharm, Ph.D.)

Assistant Professor

(Pharmaceutics)

#### SUBMITTED BY

Virendra Kumar

M. Pharm - IV Sem

Enroll No.- GGV/15/6313

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

## FORMULATION AND CHARACTERIZATION OF NYSTATIN LOADED CHITOSAN-GUAR GUM BASED NANOCAPSULES FOR THE EFFECTIVE TREATMENT OF FUNGAL KERATITIS

A

#### Dissertation

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

#### **MASTER OF PHARMACY**

(Pharmaceutics)



Session 2022-2023

#### SUPERVISOR

Dr. K. Kesavan

(M. Pharm, Ph.D.)

**Assistant Professor** 

(Pharmaceutics)

#### SUBMITTED BY

Virendra Kumar

M. Pharm - IV Sem

Enroll No.- GGV/15/6313

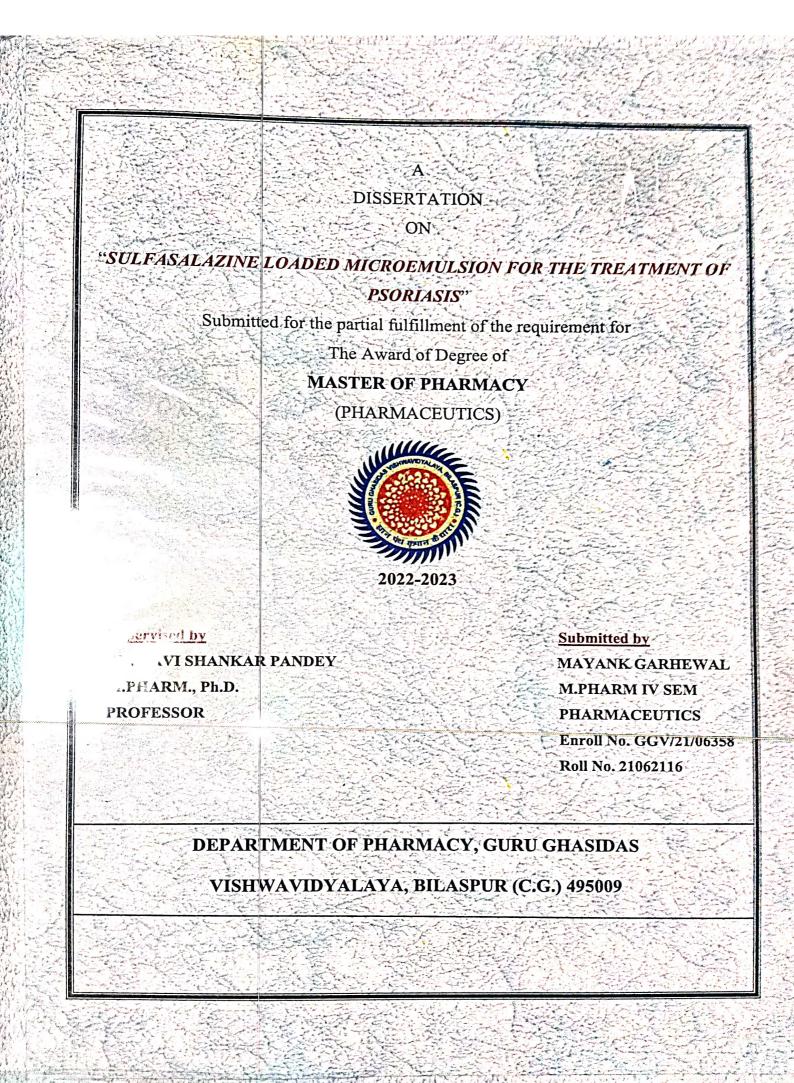
DEPARTMENT OF PHARMACY

GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G)

## LIST OF CHAPTER

CHAPTERS	TITLE	PAGE NO.
1.	Introduction	1-18
1.1	Anatomy and physiology of eye	
1.2	Fungal Keratitis	2-3
1.2.1	Pathophysiology	3
1.2.2	Pathogenesis	3-4
1.2.3	Epidemiology	4
1.2.4	Etiology	4-5
1.2.5	Diagnosis	5-6
1.2.6	Treatment of Fungal Keratitis	6
1.3	Nano carrier System for	6-7
-13	Management of Fungal Keratitis	7-10
1.4	Nano capsules	10.10
1.5	Rationale of Study	10-16
1.6	Objective Objective	17
2.	Literature review	18
2.1	Drug profile	19-33
2.2	Excipient profile	21-23
2.3	Recent development	24-29
3.	Materials and Method	29-33
3.1	Materials	34-42
		34
3.2	Pre formulation Studies	34
3.2.1	Physical properties  Maltima maint fotomore di	34
3.2.2	Melting point determination	34
3.2.3	Solubility Study	34
3.2.4	UV Spectrum of Nystatin	34
3.2.5	Preparation of calibration curve of Nystatin	34
3.2.6	FTIR spectrum of drug and excipient	35
3.3	Method of preparation	35-36
3.4	Characterization of developed CGNCs	36-38
3.5	In-vitro Drug Release Study	38
3.6	Mechanism of drug Release	38-39
3.7	Antifungal Efficacy Studies	39
3.7.1	Determination of minimum inhibitory concentration (MIC)	39

	I Witne Antifrage ( Activity	
3.7.2	In-Vitro Antifungal Activity	39
3.8	Corneal permeation study	39-40
3.9	Irritation study	40
3.9.1	HET-CAM irritation test	40
3.9.2	Histopathology study	40-41
3.10	Pharmacodynamics study	41
3.11	Statistical analysis	42
4.	Results and Discussion	43-68
4.1	Pre formulation Studies	43
4.1.1	Physical properties	43
4.1.2	Melting point determination	43
4.1.3	Solubility Study	44
4.1.4	UV Spectrum of Nystatin	44
4.1.5	Preparation of calibration curve	45
	of Nystatin	
4.1.6	FTIR spectrum of drug,	46-49
	excipients and NYS loaded	
	CGNCs	
4.2	Method of preparation	50
4.3	Characterization of developed	50-57
	CGNCs	
4.4	In-vitro Drug Release Study	57-58
4.5	Mechanism of drug Release	59-61
4.6	Antifungal Efficacy Studies	62
4.6.1	Determination of minimum	62
	inhibitory concentration (MIC)	
4.6.2	In-Vitro Antifungal Activity	62-63
4.7	Corneal permeation study	64-65
4.8	Irritation study	65
4.8.1	HET-CAM irritation test	65-66
4.8.2	Histopathology study	66-67
4.9	Pharmacodynamics study	67-68
5.	Summary and conclusion	69-71
6.	Bíbliography	72-79



# A DISSERTATION ON

## "SULFASALAZINE LOADED MICROEMULSION FOR THE TREATMENT OF PSORIASIS"

Submitted for the partial fulfillment of the requirement for

The Award of Degree of

**MASTER OF PHARMACY** 

(PHARMACEUTICS)



#### Supervised by

DR. RAVI SHANKAR PANDEY

PHARM., Ph.D.

PROFESSOR

#### Submitted by

MAYANK GARHEWAL
M.PHARM IV SEM
PHARMACEUTICS
Enroll No. GGV/21/06358
Roll No. 21062116

## DEPARTMENT OF PHARMACY, GURU GHASIDAS

VISHWAVIDYALAYA, BILASPUR (C.G.) 495009



### DEPARTMENT OF PHARMACY, GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.), 495009

(A Central University Established by the Central University Act-2009 No-25 of 2009) Tel.No.07752-260027; FaxNo.07752-260148.

## FORWARDING CERTIFICATE

This is to certify that MR. MAYANK GARHEWAL M. Pharm IV semester (Pharmaceutics) of this institute has submitted his dissertation work entitled "SULFASALAZINE LOADED MICROEMULSION FOR TREATMENT OF PSORIASIS" for the partial fulfilment of the equirement for the award of degree of Master of Pharmacy (Pharmaceutics) with his truly and onestly observed inference during his research work under the supervision of DR. RAVI SHANKAR ANDEY. His work is original, satisfactory and is not submitted anywhere else for the award of any egree.

hereby forward his dissertation for the award of M. Pharm. degree in Pharmaceutics during the cademic session 2022-2023.

HEAD OF DEPARTMENT

Head

Department of Pharmacy
Guru Ghasidas Vishwavidyalaya
(A Central University)
Bilaspur (C.G.)

## LIST OF CHAPTERS

S.NO	СНАРТЕ	ERS	PAGE NO
10 d	CHAPTER-01 (IN	TRODUCTION)	
1.1	Psoriasis		1
1.2	Types of psoriasis and their man	nifestation	2-3
1.3	Pathophysiology of psoriasis: C	Current theories of pathogenesis	3-4
1.4	Epidemiology		4
1.5	Family history and genetics		4-5
1.6	Psoriasis related disability burd	en worldwide	5
1.7	Effect of psychology and menta	al health	6
1.8	Etiology of psoriasis	The second secon	6-7
1.9	Diagnostic Feature	The second secon	7-8
1.10	Treating the skin symptoms		8-10
1.11	Microemulsion	the additional property	10-11
1.11.1	Important characteristics of mi	croemulsion	11
1.11.2	Microemulsion as drug deliver	y systems	11-12
1.11.3	Disadvantages of microemulsic	on	13
1.11.4	Components of microemulsion	formulation	13-14
1.11.5	Method of preparation of micro	oemulsion	14-15
1.11.6	Types of microemulsion		15
1.11.7	Factors affecting the microemu	ılsion formulation	16
	CHAPTER-02 (LIT	ERATURE REVIEW)	
2.1	Psoriasis		17
2.2	Microemulsion	The second secon	17-18
2.3	Rationale/Hypothesis		19
2.4	Plan of work		20
4	CHAPTER-03 (MAT	TERIAL AND METHODS)	
3.1	Material and methods		21
3.2	Drug & excipient profile		22-26