

**ISOLATION AND ANTIOXIDANT ACTIVITY OF
MANGIFERAINDICA EXTRACTS AND MANGIFERIN ON
“GOAT HEART MITOCHONDRIA”**

A

Dissertation

Submitted for

Partial fulfillment of the Requirement for the Award of the degree of

**Master in Pharmacy
(Pharmacognosy)**



Session 2020-2022

SUPERVISED BY

Dr. Vinod D. Rangari

(Professor)

Department of Pharmacy

SUBMITTED BY

Monika Ray

(Pharmacognosy)

Enroll No.GGV/16/6119

**DEPARTMENT OF PHARMACY
GURU GHASIDAS VISHWAVIDYALAYA BILASPUR CHHATTISGARH
(A Central University Established by the Central Universities Act, 2009 No.25 of 2009)**

**ISOLATION AND ANTIOXIDANT ACTIVITY OF
MANGIFERA INDICA EXTRACTS AND MANGIFERIN
ON "GOAT HEART MITOCHONDRIA"**

A

Dissertation

Submitted for

Partial fulfillment of the Requirement for the Award of the degree of

**Master in Pharmacy
(Pharmacognosy)**



Session 2020-2022

SUPERVISED BY

Dr. Vinod D. Rangari

(Professor)

Department of Pharmacy

SUBMITTED BY

Monika Ray

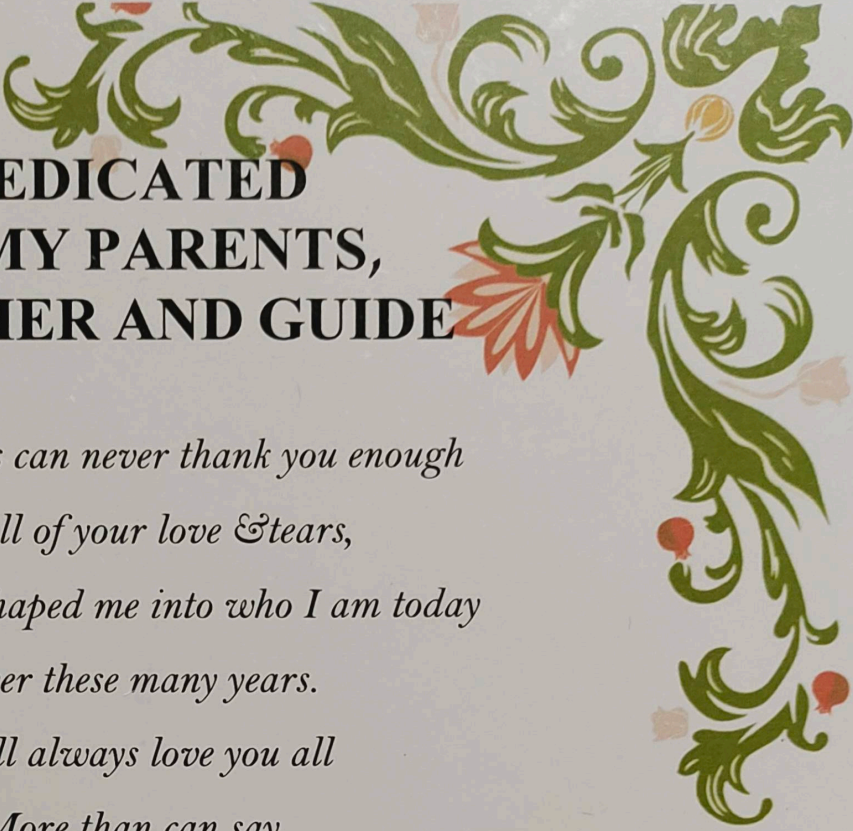
(Pharmacognosy)

Enroll No. GGV/16/6119

DEPARTMENT OF PHARMACY



GURU GHASIDAS VISHWAVIDYALAYA BILASPUR CHHATTISGARH

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



**DEDICATED
TO MY PARENTS,
BROTHER AND GUIDE**

*Words can never thank you enough
For all of your love & tears,
Those have shaped me into who I am today
Over these many years.
I will always love you all
More than can say
And I want to thank you all for
The one I am today
I couldn't have asked the lord above
For better than your love and support.*





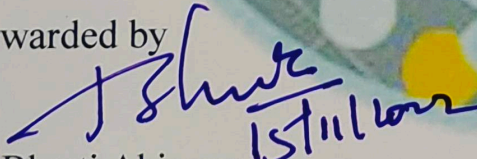
DEPARTMENT OF PHARMACY
GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)
(A Central University Established by Central Universities Act 2009 No. 25 of 2009)
Tel. no. 07752-260027; Fax No. 07752-260148

Forwarding Certificate

This is to certify that **MONIKA RAY**, D/o Mrs. Sushila Ray, a student of M. pharma IV semester (Pharmacognosy branch), Department of Pharmacy has submitted her thesis entitled "*Isolation and Antioxidant activity of M.indica extract and mangiferin on Goat Heart mitochondria*" for partial fulfillment of the requirement for the Degree of Master of Pharmacy (Pharmacognosy). She has completed his thesis under the supervision of Dr. Vinod Rangari, Professor (Department of Pharmacy). Her work is original, satisfactory and is not submitted anywhere else for the award of any degree.

I hereby forward her thesis for the award of the degree of the Master of Pharmacy (Pharmacognosy) IV semester for the session 2020-2022.

Forwarded by


Dr. Bharti Ahirwar
(Head of the department)

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

Place: Bilaspur

Date: 15/11/2022



DEPARTMENT OF PHARMACY
GURU GHASIDAS VISHWAVIDAYALAYA BILASPUR (C.G.)
(A Central University Established by Central Universities Act 2009 No. 25 of 2009)
Tel. no. 07752-260027; Fax No. 07752-260148

CERTIFICATE

This is to certify that **MONIKA RAY**, D/o Sushila Ray a student of M. Pharma IV(Pharmacognosy), Department of Pharmacy has submitted her dissertation work entitled "*Isolation and Antioxidant activity of M.indica extract and mangiferin on Goat Heart mitochondria*" for partial fulfillment of the requirement for the degree of the **Master of Pharmacy**(Pharmacognosy). She has performed her research work with truly and honestly observed inference. She has completed her thesis under my supervision. Her work is original, satisfactory and is not submitted anywhere else for the award of degree. I hereby forward her thesis for the Award of the degree of the Master of Pharmacy (Pharmacognosy) during the academic session 2020- 2022.

I hereby forward her dissertation for the evaluation.

SUPERVISED BY

Dr. Vinod Rangari
M.Pharma, PhD
(Professor)
Department of Pharmacy
Guru Ghasidas Vishwavidyalaya
Bilaspur (C.G.) - 495009, India
DR. VINOD D. RANGARI
Professor (PHARMACY)
Guru Ghasidas Vishwavidyalaya
BILASPUR (C.G.)

Place: Bilaspur

Date: 15/01/22



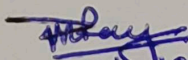


DEPARTMENT OF PHARMACY
GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)
(A Central University Established by Central Universities Act 2009 No. 25 of 2009)
Tel. no. 07752-260027; Fax No. 07752-260148

DECLARATION

I hereby declare that the work incorporated in the thesis on the topic entitled "*Isolation and Antioxidant activity of **M. indica** extract and mangiferin on Goat Heart mitochondria*" embodies my own work except the guidance and the suggestion received from my supervisor. Dr. Vinod Rangari, Professor (Pharmacognosy) Department of Pharmacy, Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G) for partial fulfillment of the requirement for the **Degree of Master of Pharmacy in Pharmacognosy** during the academic session 2020- 2022.

I further declare that my work is original, satisfactory and the dissertation does not contain any part of any work, which has been submitted for the award of any degree elsewhere to the best of my knowledge.


15/11/2022

MONIKARAY

M.Pharma IV Semester
(Pharmacognosy)
Enroll No. GGV/16/6119

Place: - Bilaspur

Date: - 15/NOV/2022



ACKNOWLEDGEMENT

It's a privilege and pleasure to acknowledge the contributions of many persons who have been inspirational and supportive throughout my work, undertaken and endowed me with the most precious knowledge to see success in my endeavor. My work, bears the imprint of all those people, I am grateful to. The note of thanks starts with remembering the blessing of almighty god who actually gave the opportunity, inspiration and energy to craft work and helped me at all they're in difficult times when things looked bleak.

It is said that only hard-work, and will power is not enough for getting success, but the efforts for getting success are to be guided and motivated. In this regard, it gives me a feeling of great pleasure and endless satisfaction for expressing my deep sense of gratitude & honor for my immensely respected guide **Dr. Vinod D. Rangari**, M. Pharm, PhD., Professor, Guru Ghasidas Vishwavidyalaya, Bilaspur, for his invaluable guidance and untiring supervision which enabled me in successful completion of my project work.

I also express my gratitude to head of department, Dr. Vinod D Rangari sir and Dr. Bharti Ahirwar for providing me all facilities throughout the dissertation. I am also thankful to other department of my university for their great support and generous contribution during the entire research specially Department of Botany, Dr. P.K. Bajpai (H.O. D), Dr G.K. Patra (H.O.D), Department of chemistry.

The work was indeed a mammoth task to accomplish and would not have been possible without active co-operation from our teachers Dr. Bharti Ahirwar, Dr. Arjun Patra, Dr. V. Mandal, Dr. Neeli Rose Beck whose support was just very important. I am also thankful to all non-teaching staff specially Mr. Prasant Mishra, (Instrument Lab In charge) and Mr. Virendra

Verma, Mrs. Veena Vaishnava for their support while using various instrument as & when required.

I am very thankful to Dr. Debasish Bandyopadhyay (H.O.D) Professor, Department of Physiology and oxidative stress, University of Calcutta, and their students Miss Adrita, Miss Priyanka (PhD scholar) for providing facility and I am also very thankful to other faculties of department of Pharmacy. I would like to thank Mrs. Varshika Rangri for providing the knowledge and I would like to thank NIPER Guwahati for performing the LC-MS of sample and thank you to the Anticancer Drug Screening Facility (ACDSF), ACTREC Tata Memorial Center Khargpur, Navi Mumbai, for cancer study of different cell line.

Thank You
Monika Ray

LIST OF CONTENTS

CHAPTER 1

1-27

1. INTRODUCTION

- 1.1 MEDICINAL PLANT
- 1.2 ETHANOMEDICAL HISTORY
- 1.3 PREVALENCE
- 1.4 ANTIOXIDANTS
- 1.5 FREE RADICALS
- 1.6 CONCEPT OF FREE RADICALS:
- 1.7 HUMAN ILLNESSES AND OXIDATIVE STRESS
- 1.8 LIPID PEROXIDATION
- 1.9 MANGIFERIN'S DIETARY SOURCES AND INFLUENCING FACTORS
- 1.10 ANTIOXIDANT DEFENSE SYSTEM
- 1.11 MECHANISM OF ACTION OF ANTIOXIDANT:
- 1.12 FACTORS AFFECTING ANTIOXIDANT
- 1.13 CLASSIFICATION OF ANTIOXIDANTS
- 1.14 TYPES OF ANTIOXIDANT
- 1.15 HOW THEY WORK?
- 1.16 FUNCTIONS OF ANTIOXIDANTS
- 1.17 PRO-OXIDANTS
- 1.18 ANTIOXIDANTS USE
- 1.19 GOAT HEART MITOCHONDRIA

2. CANCER

- 2.1 ANTICANCER
- 2.2 ORIGIN OF CANCER
- 2.3 SYMPTOMS
- 2.4 THE FOUR STAGES OF CANCER
- 2.5 CLASSIFICATION OF CANCER
- 2.6 DIAGNOSIS OF CANCER
- 2.7 CANCER TREATMENT

- 2.8 THE SIDE EFFECTS OF CANCER TREATMENT
- 2.9 LOWER THE RISK OF CANCER
- 2.10 COMPLEMENTARY AND ALTERNATIVE MEDICINE
- 2.11 REFERENCES

CHAPTER 2

28-40

LITERATURE REVIEW

HOW TO DO LITRETURE SURVEY?

2.1 PHYTOCHEMICAL REVIEW

2.2 PHARMACOLOGICAL REVIEW

2.2.1 ANTIOXIDANT ACTIVITY OF *M. Indica* EXTRACTS AND MANGIFERIN

2.2.2 ANTICANCER ACTIVITY OF *M. Indica* EXTRACTS AND MANGIFERIN

2.3 REFERENCES

CHAPTER 3

41-57

PLANT PROFILE AND DRUG PROFILE

3.1 PLANT PROFILE

3.1.1 FAMILY OF ANACARDIACEAE

3.1. 2 SPECIES *Mangifera indica*

- GENERAL INFORMATION

3.1.3 CLASSIFICATION

3.1.4 MORPHOLOGY

3.1.5 CHEMICAL CONSTITUENTS

3.1.6 MACROSCOPIC CHARACTER OF THE PLANT

3.1.7 USES OF *MANGIFERA INDICA*

3.1.8 PHARMACOLOGICAL PROFILE

3.2 DRUG PROFILE

3.2.1 PHARMACOKINETICS AND ABSORPTION

3.3 REFERENCES

CHAPTER 4	58-59
AIM AND OBJECTIVE	
CHAPTER 5	60-61
PLAN OF WORK	
CHAPTER 6	62-96
MATERIAL AND METHOD	
6.1 PROCUREMENT OF CRUDE DRUGS	
6.1.1 PLANT MATERIAL	
6.1.2 CHEMICAL REAGENTS	
6.1.3 COLLECTION AND AUTHENTICATION	
6.1.4 PLANT IDENTIFICATION	
6.1.5 PLANT COLLECTION	
6.2 EXTRACTION AND ISOLATION OF MANGIFERIN FROM <i>M. INDICA</i>	
EXTRACTS	
6.2.1 THE BASIC PARAMETERS INFLUENCING AN EXTRACT'S QUALITY ARE	
6.2.2 EFFECT OF PHYTOCHEMICAL PLANT EXTRACTED DEPENDS ON	
6.2.3 VARIATIONS IN VARIOUS EXTRACTION METHODS AFFECTING THE QUANTITY AND SECONDARY METABOLITE COMPOSITION OF AN EXTRACT DEPENDING ON	
6.2.4 PLANT MATERIAL	
6.2.5 CHOICE OF SOLVENTS	
6.2.6 A GOOD SOLVENT PROPERTY IN PLANT EXTRACTIONS INCLUDE	
6.2.7 SOXHLET EXTRACTION	
6.2.8 PARAMETERS FOR SELECTING AN APPROPRIATE EXTRACTION METHOD	
6.3 ISOLATION AND CHARACTERISATION OF ETHANOL EXTRACT OF BOTH BARK AND LEAF <i>M. INDICA</i>	
6.3.1 GENERAL CONCEPT OF CHROMATOGRAPHY	
6.3.2 THIN LAYER CHROMATOGRAPHY [TLC]	
6.3.3 COLUMN CHROMATOGRAPHY	

6.4 LLE (LIQUID-LIQUID EXTRACTION)

6.4.1 ADVANTAGE OF LIQUID- LIQUID EXTRACTION

6.4.2 DISADVANTAGE OF LIQUID- LIQUID EXTRACTION

6.5 PRELIMINARY PHYTOCHEMICAL SCREENING

6.5.1 DETECTION OF ALKALOIDS

6.5.2 DETECTION OF TANNINS

6.5.3 DETECTION OF PHENOLS

6.5.4 DETECTION OF FLAVONOIDS

6.5.5 DETECTION OF SAPONINS

6.5.6 PHYTOCHEMICAL SCREENING OF *M. Indica* extracts.

6.6 CHROMATOGRAPHIC STUDIES OF EXTRACTS

6.6.1 PROCEDURE FOR TLC

6.6.2 SELECTION OF SOLVENT FOR TLC

6.6.3 COMMON SOLVENT COMBINATIONS

6.7 THIN LAYER CHROMATOGRAPHY AND HPTLC (HIGH PERFORMANCE THIN LAYER CHROMATOGRAPHY)

6.7.1 CHROMATOGRAM OF *MANGIFERA INDICA* EXTRACT

6.8 LC- MS ANALYSIS OF MANGIFERIN

6.8.1 LC -MS

6.8.2 LC-MS INSTRUMENT AND PROCEDURE

6.9 ESTIMATION OF TOTAL PHENOLIC AND TOTAL FLAVONOID FROM AQUEOUS AND METHANOLIC EXTRACTS OF M. INDICA

6.10 ANTIOXIDANT ACTIVITY OF *M. INDICA* EXTRACT AND MANGIFERIN BY GOAT HEART MITOCHONDRIA MODEL

6.10.1 MITOCHONDRIAL TISSUE COLLECTION

6.10.2 EXPERIMENTAL PROCEDURE

6.10.3 INCUBATION WITH Cd AND MELATONIN

6.10.4 ESTIMATION OF DIFFERENT BIOCHEMICAL PARAMETERS

6.11 ANTICANCER ACTIVITY

6.12 REFERENCES

CHAPTER 7

97-132

RESULT AND CONCLUSION

7.1 PHYTOCHEMICAL STANDARDIZATION

7.1.1 PERCENTAGE YIELD

7.1.2 PRELIMINARY PHYTOCHEMICAL SCREENING

7.2 ESTIMATION OF TOTAL POLYPHENOLIC CONTENTS

7.3 TEST SOLUTION AND ASSAY

7.4 ESTIMATION OF TOTAL FLAVONOIDS FROM DIFFERENT EXTRACTS OF ETHANOLIC EXTRACT OF *M. INDICA*.

7.5 TEST SOLUTION AND ASSAY

7.6 CHROMATOGRAPHIC STUDIES

7.6.1 SOLVENT SYSTEM DEVELOPED BY TLC FOR ETHANOL EXTRACT OF *M. indica*

7.6.2 SOLVENT SYSTEM DEVELOPED BY HPTLC FOR ETHANOL EXTRACT OF *M. indica*

7.6.3 DISCUSSION

7.7 SPECTROSCOPICAL ANALYSIS

7.7.1 DISCUSSION

7.8 LC-MS SPECTROSCOPICAL ANALYSIS

7.8.1 DISCUSSION

7.9 CONCLUSION

7.10 EVALUTION OF ANTIOXIDANT ACTIVITY OF *M. Indica* EXTRACTS.

7.11 ANTICANCER

CHAPTER 8

133-143

8.1 FUTURE ASPECTS

8.2 REFERENCES

LIST OF CONTENTS