THIS THESIS IS

DEDICATED TO MY

BELOVED PARENTS AND SISTERS

AND

MY SUPERVISOR

FOR THEIR CONSTANT INSPIRATION, WHOLE HEARTED COOPERATION AND PROPER VALUABLE GUIDANCE

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https://www.hindawi.com/journals/ijps/2019/1695189/
https://www.researchgate.net/publication/51653252_Solid_Inclusion_Complexes_of_Vanillin_with_Cyclodextrins_Their_Formation_Characterization_and_High-Temperature_Stability
https://www.nature.com/articles/s41598-018-31373-x
https://www.researchgate.net/publication/327287085_Study_to_Probe_Subsistence_of_Host-Guest_Inclusion_Complexes_of_a_and_b-Cyclodextrins_with_Biologically_Potent_Drugs_for_Safety_Regulatory_Dischargement
https://www.intechopen.com/chapter/pdf-preview/56279
https://worldwidescience.org/topicpages/c/cyclodextrin+inclusion+complex.html
https://cyberleninka.org/article/n/1411489

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CERTIFICATE

I, certify that Mr. Niloy Roy has prepared his thesis entitled "**Synthesis, Characterization and Innovative Applications of Inclusion Complexes and Nanocomposites of Some Biologically Potent Molecules**", for the award of Ph. D. degree (Doctor of Philosophy) from the University of North Bengal, under my guidance. He has carried out his work at the Department of Chemistry, University of North Bengal. The contents of this thesis, in full or in parts, have not been submitted to any other Institution or University for the award of any degree or diploma.

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DECLARATION

I declare that the thesis entitled "**SYNTHESIS, CHARACTERIZATION AND INNOVATIVE APPLICATIONS OF INCLUSION COMPLEXES AND NANOCOMPOSITES OF SOME BIOLOGICALLY POTENT MOLECULES**" has been prepared by me for the degree of **Doctor of Philosophy (Ph. D.)** under the supervision of Dr. Mahendra Nath Roy, Professor, Department of Chemistry, University of North Bengal and has not formed the basis for the award of any other degree or diploma, in this or any other Institution or University.

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This thesis would not have been possible without support of many people who were always standing there when I needed them the most.

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I also express my profound sense of gratitude to the honourable faculty members' and officers of Department of Chemistry, University of North Bengal for their helpful assistance and continual inspiration during the course of my research. I am grateful to the University authority for providing laboratory facilities, especially USIC, NBU for giving me instrumental facilities.

My truthful gratefulness to my beloved father and mother, Mr. Paresh Chandra Roy, and Mrs. Sipra Roy and my dearest elder sisters, Koyelia Roy and Kabita Roy, for their constant supports, encouragements and contributions with a view to building my career and their continuous inspiration went a long way to the completion of the thesis. Without their constant support I would not be where I am now. My heartfelt thanks and bleesings to my lovely nephew Navonil, my brother-in-laws Abhijit Roy Mondal and Ashok Adhikari for their kind cooperation.

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I express my special thank to the editors, co-editors and reviewers of my publications as the comments and suggestions from them have also been valuable for carrying out the research works. All the cited references are the major sources of information which helps us to develop new ideas, and hence, all the authors/researchers behind the cited works are hereby sincerely thanked.

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PREFACE

The research work in the thesis entitled "**SYNTHESIS, CHARACTERIZATION AND INNOVATIVE APPLICATIONS OF INCLUSION COMPLEXES AND NANOCOMPOSITES OF SOME BIOLOGICALLY POTENT MOLECULES**" was initiated for about three years before under the supervision of **Dr. Mahendra Nath Roy**, **Prof. of Chemistry in the Department of Chemistry, University of North Bengal.**

This work is an exertion to emphasize the supramolecular inclusion complexation of biologically active molecules and some graphene based nanocomposites to explore their physicochemical and Spectrochemical properties.

Throughout my research work, I was delighted to participate in various seminars/ symposiums/conferences in different universities as well as institutions. I was really encouraged by listening and interacting with renowned experts, reviewers and visiting Scientists. I was even lucky enough to publish the research works in international and national journals of repute, which are included in the thesis.

In carrying out with general practice of reporting scientific observation, due acknowledgement has been made whenever the work described was based on the finding of other researchers. I must take the responsibility of any unintentional oversight and errors, which might have sneaked in spite of precautions.

I am confident of surmounting challenges in my future life putting into action all the acquired knowledge and experiences all over my research period.

LIST OF TABLES

LIST OF FIGURES

LIST OF SCHEMES

ABBREVIATIONS

CD	Cyclodextrin
αCD	α-cyclodextrin
βCD	β-cyclodextrin
HP-β-CD	Hydroxy Propyl-β-cyclodextrin
IC	Inclusion complex
TGC	Trigonelline Hydrochloride
RB	Rebamipide
NB	Nile blue
AMB	Ambroxol hydrochloride
UMB	Umbelliferone
GO	Graphene Oxide
rGO	Reduced Graphene Oxide
µm	Micrometre
Å	Angstrom
C	Carbon
H	Hydrogen
O	Oxygen
Cm	Centimetre
CNTs	Carbon Nanotubes
DMF	Dimethylformamide
DMSO	Dimethyl sulfoxide
EtOH	Ethanol
Eq.	Equation
eV	Electron Volt
Fig.	Figure
FTIR	Fourier Transform Infrared
2D NMR	Two Dimensional Nuclear Magnetic Resonance
ROESY	Rotating Frame Overhauser Enhancement Spectroscopy
ESI-MS	Electron Ionization Spray- Mass Spectrometry
g	Gram
hrs	Hours

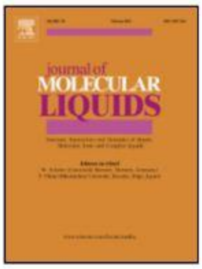
ABBREVIATIONS

Hz	Hertz
FTIR	Fourier Transform Infrared spectroscopy
K	Kelvin
M	Molar
m	Meter
mg	Milligram
min	Minute
mL	Millilitre
μM	Micromolar
NIR	Near Infrared
Nm	Nanometer
^0C	Degree Celsius
pH	Potential of Hydrogen
rpm	Revolutions Per Minute
SEM	Scanning Electron Microscopy
SWNT	Single Walled Carbon Nanotube
TEM	Transmission Electron Microscope
DLS	Dynamic Light Scattering
TGA	Thermogravimetric Analysis
UV-vis	Ultraviolet-visible
wt %	Weight percentage
MD	Molecular Dynamics

APPENDIX-A

LIST OF PUBLICATIONS/COMMUNICATION(S)

1. N. Roy, P. Bomzan, D. Roy, B. Ghosh and M. N. Roy, Exploring β-CD Grafted GO Nanocomposites with an Encapsulated Fluorescent Dye duly Optimized by Molecular Docking for Better Applications.



Journal of Molecular Liquids, 748, (2021) 137372

(Included in the thesis)

2. N. Roy, P. Bomzan and M. N. Roy, Probing Host-Guest inclusion complexes of Ambroxol Hydrochloride with α- & β-Cyclodextrins by physicochemical contrivance subsequently optimized by molecular modeling simulations.

Chemical Physics Letters, 748, (2020) 137372

(Included in the thesis)

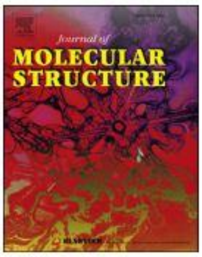
3. N. Roy, B. Ghosh, D. Roy, B. Bhaumik and M. N. Roy, Exploring the Inclusion Complex of a Drug (Umbelliferone) with α-Cyclodextrin Optimized by Molecular Docking and Increasing Bioavailability with Minimizing the Doses in Human Body.

ACS OMEGA

ACS Omega, 5, 46, (2020) 30243-30251

(Included in the thesis)

4. N. Roy, R. Ghosh, K. Das, D. Roy, T. Ghosh and M. N. Roy, Study to synthesize and characterize host-guest encapsulation of antidiabetic drug (TgC) and hydroxy propyl-β-cyclodextrin augmenting the antidiabetic applicability in biological system.



Journal of Molecular Structure 1179 (2019) 642-650

(Included in the thesis)

5. N. Roy, B. Mahato, D. Roy, K. Das and M. N. Roy, Exploring inclusion complexes of cyclodextrins with quinolinone based gastro protective drug for enhancing bioavailability and sustained dischargement.

Zeitschrift für Physikalische Chemie, 2020, 1 (ahead-of-print)

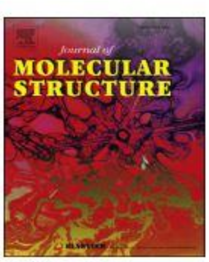
(Included in the thesis)

6. A. Yasmin, B. K. Barman, **N. Roy,** and M. N. Roy, Synthesis and Characterization of Host Guest Inclusion Complexation of Cyclic Oligosaccharide with Industrially Potent Dye in Different Phases by Physicochemical Contrivance.

Chemistry SELECT Full Papers

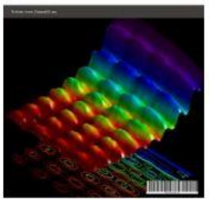
ChemistrySelect 2020, 5, 1803 –1808

7. P. Bomzan, **N. Roy,** A. Sharma, V. Rai, S. Ghosh, A. Kumar and M. N. Roy, Molecular Encapsulation Study of Indole-3-methanol in Cyclodextrins: Effect on Antimicrobial Activity and Cytotoxicity.



Journal of Molecular Structure 2020, 129093

8. H. Rahaman, **N. Roy,** A. Roy, S. Ray and M. N. Roy, Exploring Existence of Host-Guest Inclusion Complex of β-Cyclodextrin of a Biologically Active Compound with the Manifestation of Diverse Interactions.



Emerging Science Journal, 2018, 2(5), 251-260

9. A. Dutta, **N. Roy,** K. Das, D. Roy, R. Ghosh and M. N. Roy, Synthesis and Characterization of Host Guest Inclusion Complexes of Cyclodextrin Molecules with Theophylline by Diverse Methodologies.

Emerging Science Journal, 2020, 4(1), 52-72

APPENDIX-B

LIST OF SEMINARS/CONFERENCES ATTENDED

1. National Seminar on "Frontiers in Chemistry – **2020**" Organised by: Department of Chemistry, University of North Bengal & CRSI North Bengal Local Chapter, March 5. ***(Presented a poster)***

2. SERB sponsored National Conference on "Green Chemistry: An Alternative of Conventional Chemistry" Organised by: Department of Chemistry, CBPBU, Cooch Behar, West Bengal, 20th – 21st September **2019**. ***(Best poster Presentation Award)***

3. National Seminar on "Frontiers in Chemistry – **2019**" Organised by: Department of Chemistry, University of North Bengal & CRSI North Bengal Local Chapter. ***(Presented a poster)***

4. International Seminar on "Frontiers in Chemistry **2018**" Organised by: Department of Chemistry, University of North Bengal & CRSI North Bengal Local Chapter. ***(Presented a poster)***

5. National Seminar on "Frontiers in Chemistry – **2017**", Funded by: University Grants Commission and SAP (DRS-III), Organised by: Department of Chemistry, University of North Bengal.

6. National Seminar on "Frontiers in Chemistry – **2016**", Funded by: University Grants Commission and SAP (DRS-III), March 07-08, Organised by: Department of Chemistry, University of North Bengal.

7. One-day seminar on "Recent Trends on Chemistry and Biology Interface", August 28, **2015**, Organised by: Chemical Research Society of India, NBU-Local Chapter, Department of Chemistry, University of North Bengal.

8. Science Academies' Lecture Workshop on "Spectroscopy of Emerging Materials", November 26-27, **2014**, Organised by: Department of Chemistry, University of North Bengal.

9. One day Workshop on "Workshop on Crystallography", December 9, **2014**, Organised by: North Bengal Science Centre, National Council of Science Museums & Ministry of Culture Govt. of India.