

*This Thesis is dedicated  
To  
My beloved Parents, Sister  
and  
My Husband*

## DECLARATION

I declare that the thesis entitled "STUDY TO EXPLORE INCLUSION COMPLEXATIONS AND ASSORTED INTERACTIONS OF SOME INDUSTRIALLY AND BIOLOGICALLY SIGNIFICANT MOLECULES IN DIVERSE SYSTEMS" has been prepared by me under the guidance of Dr. Mahendra Nath Roy, Professor of Chemistry, University of North Bengal. No part of this thesis has formed the basis for the award of any degree or fellowship previously.

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### CERTIFICATE

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|          |                                                                                                                                                                                                                                                                                          |                                                                                          |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>W</b> | URL: <a href="http://www.rsc.org/suppdata/c5/ra/c5ra24102b/c5ra24102b1.pdf">http://www.rsc.org/suppdata/c5/ra/c5ra24102b/c5ra24102b1.pdf</a><br>Fetched: 2021-07-06T00:52:56.3270000                                                                                                     |  11   |
| <b>W</b> | URL: <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6115366/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6115366/</a><br>Fetched: 2021-12-27T12:04:25.8170000                                                                                                                   |  14   |
| <b>W</b> | URL: <a href="https://pubs.rsc.org/en/content/getauthorversionpdf/C4RA07877B">https://pubs.rsc.org/en/content/getauthorversionpdf/C4RA07877B</a><br>Fetched: 2022-01-11T08:35:45.9200000                                                                                                 |  8   |
| <b>W</b> | URL: <a href="https://ir.nbu.ac.in/bitstream/123456789/2854/17/17_chapter%205.pdf">https://ir.nbu.ac.in/bitstream/123456789/2854/17/17_chapter%205.pdf</a><br>Fetched: 2022-02-15T06:21:35.1930000                                                                                       |  16 |
| <b>W</b> | URL: <a href="http://14.139.211.59/bitstream/123456789/2648/16/16_chapter%204.pdf">http://14.139.211.59/bitstream/123456789/2648/16/16_chapter%204.pdf</a><br>Fetched: 2022-02-15T06:21:35.2370000                                                                                       |  6  |
| <b>W</b> | URL: <a href="https://openresearchlibrary.org/ext/api/media/8585e356-73a7-4173-a2d8-425b0bdc1dcd/assets/external_content.pdf">https://openresearchlibrary.org/ext/api/media/8585e356-73a7-4173-a2d8-425b0bdc1dcd/assets/external_content.pdf</a><br>Fetched: 2021-04-14T07:31:38.2330000 |  10 |
| <b>W</b> | URL: <a href="https://www.ijesr.com/iebrary/e14/911425989.pdf">https://www.ijesr.com/iebrary/e14/911425989.pdf</a><br>Fetched: 2022-02-15T06:21:35.4800000                                                                                                                               |  3  |
| <b>W</b> | URL: <a href="https://www.nature.com/articles/s41598-018-31373-x">https://www.nature.com/articles/s41598-018-31373-x</a><br>Fetched: 2019-11-30T13:19:15.0370000                                                                                                                         |  1  |
| <b>W</b> | URL: <a href="https://innovareacademics.in/journals/index.php/ajpcr/article/download/15164/9522">https://innovareacademics.in/journals/index.php/ajpcr/article/download/15164/9522</a><br>Fetched: 2022-02-15T06:21:47.5130000                                                           |  1  |

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## **PREFACE**

The work in the thesis entitled “**STUDY TO EXPLORE INCLUSION COMPLEXATIONS AND ASSORTED INTERACTIONS OF SOME INDUSTRIALLY AND BIOLOGICALLY SIGNIFICANT MOLECULES IN DIVERSE SYSTEMS**” was initiated under the supervision of Dr. Mahendra Nath Roy, Prof. of Chemistry in the Department of Chemistry, University of North Bengal.

The overall work is an endeavour to explore the host – guest inclusion complexation of some industrially as well as biologically significant molecules with cyclodextrins. The work also includes the study of molecular interactions between two bioactive molecules by some physicochemical methodologies.

During my research work, I got opportunities to participate in several meets and seminars across the country. I felt highly motivated by listening and interacting with eminent experts and scientists.

In executing general practice of reporting scientific observation, due acknowledgement has been made whenever the work described was based on the findings of the other investigators. I must take the responsibility of any unintentional oversights and errors, which might have crept in spite of precautions.

I am hoping that all the learning outcomes that I have gathered during the course of my research will definitely make me stronger to take challenges.

## LIST OF TABLES

| CHAPTERS          | TABLES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PAGE NO.     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Chapter IV</b> | <p><b>Table 1:</b> Source and purity of the chemicals</p> <p><b>Table 2:</b> Experimental values of density (<math>\rho</math>), viscosity (<math>\eta</math>) and refractive index (<math>n_D</math>) at 298.15 K and at pressure 1.013 bar of different mass fraction (<math>w_1</math>) of aq. gallic acid mixtures*</p> <p><b>Table 3:</b> Experimental values of density (<math>\rho</math>) and viscosity (<math>\eta</math>), Uracil in different mass fractions of aqueous Gallic acid mixture (<math>w_1</math>) at three different temperatures and at pressure 1.013 bar*</p> <p><b>Table 4:</b> Apparent molar volume (<math>\phi_V</math>) and <math>(\eta_r-1)/\sqrt{m}</math> of uracil in different mass fraction (<math>w_1</math>) of aqueous gallic acid mixtures at three different temperatures*</p> <p><b>Table 5:</b> Limiting apparent molar volume (<math>\phi_V^0</math>), experimental slope (<math>S_V^*</math>), viscosity <i>A</i>- and <i>B</i>-coefficient of uracil in different mass fraction (<math>w_1</math>) of aqueous gallic acid mixtures at three different temperatures*</p> <p><b>Table 6:</b> Values of various coefficients and standard deviation of equation-3 for uracil acid in different aqueous gallic acid solutions*</p> <p><b>Table 7:</b> Limiting apparent molar expansibilities (<math>\phi_E^0</math>) for uracil in different mass fraction of aqueous gallic acid (<math>w_1</math>) at different temperature</p> <p><b>Table 8:</b> Values of <math>dB/dT</math>, <math>A_1</math>, <math>A_2</math> coefficients for the uracil in different mass fraction of aqueous gallic acid (<math>w_1</math>) at studied temperatures*</p> <p><b>Table 9:</b> Refractive index (<math>n_D</math>), molar refraction (<math>R_M</math>) and limiting molar refraction (<math>R_M^0</math>) uracil in different mass fraction of aqueous gallic acid solutions at 298.15 K and at pressure 1.013 bar*</p> | <b>62-66</b> |

| CHAPTERS                 | TABLES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | PAGE NO.            |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <p><b>Chapter V</b></p>  | <p><b>Table: 1:</b> Data of Job's plot of (AB+β-CD) system obtained from Uv-visible spectroscopy.</p> <p><b>Table.2:</b> Values of association constants(<math>K_a</math>) obtained by Benesi-Hildebrand method from Uv-visible spectroscopy and corresponding free energy change(<math>\Delta G^0</math>), enthalpy(<math>\Delta H^0</math>), entropy(<math>\Delta S^0</math>) of the AB.β-CD inclusion complex at 293.15K,303.15K and 313.15K.</p> <p><b>Table3.</b> <math>^1\text{H-NMR}</math> spectral data of Alibendol (AB), β-CD, AB.β-CD(IC).</p> <p><b>Table.4:</b> The chemical shift values of the protons of β-CD, Alibendol in pure state and in complexed state and their deviations from pure to complex.</p> <p><b>Table.5:</b> Data obtained from FT-IR spectroscopic study of β-CD, AB&amp; β-CD+AB IC</p> <p><b>Table S1.</b> Data of Benesi-Hildebrand double reciprocal plot of the system (Alibendol+β-CD) obtained from Uv-Vis spectroscopy at 293.15 K.</p> <p><b>Table S2.</b> Data of Benesi-Hildebrand double reciprocal plot of the system (Alibendol+β-CD) obtained from Uv-Vis spectroscopy at 303.15 K.</p> <p><b>Table S3.</b> Data of Benesi-Hildebrand double reciprocal plot of the system (Alibendol+β-CD) obtained from Uv-Vis spectroscopy at 313.15 K.</p> <p><b>Table S4.</b> The van't Hoff equation data for the calculation of thermodynamic parameters (<math>\Delta H^0</math>, <math>\Delta S^0</math>, <math>\Delta G^0</math>) of the inclusion complex (AB+β-CD).</p> | <p><b>77-80</b></p> |
| <p><b>Chapter VI</b></p> | <p><b>Table 1:</b> Association Constants obtained from Benesi-Hildebrand method (<math>K_a</math>) and change in free energy (<math>\Delta G</math>).</p> <p><b>Table S1.</b> UV-Vis spectroscopic data for the generation of Job plots of aqueous AMH+α-CD system at 298.15 K<sup>a</sup>.</p> <p><b>Table S2.</b> UV-Vis spectroscopic data for the generation of Job plots of aqueous AMH+β-CD system at 298.15 K<sup>a</sup>.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p><b>96-98</b></p> |

| CHAPTERS           | TABLES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | PAGE NO.       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
|                    | <p><b>Table S3.</b> UV-vis spectroscopic data for the Benesi-Hildebrand double reciprocal plot of (AMH+<math>\alpha</math>-CD) system at 298.15K</p> <p><b>Table S4.</b> UV-vis spectroscopic data for the Benesi-Hildebrand double reciprocal plot of (AMH+ <math>\beta</math>-CD) system at 298.15K</p> <p><b>Table S5:</b> Antimicrobial activity of drug, IC-1, IC-2 and solvent DMSO sample name against tested microorganisms. Results are expressed as Mean <math>\pm</math> SD of triplicate determinations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |
| <b>Chapter VII</b> | <p><b>Table 1.</b> Association constants (<math>K_a</math>), Gibb's free energy (<math>\Delta G^0</math>), enthalpy (<math>\Delta H^0</math>) and entropy (<math>\Delta S^0</math>) of AGT-<math>\beta</math>-CD systems from UV-Vis spectroscopy.</p> <p><b>Table 2:</b> <math>2\theta</math> values of <math>\beta</math>-CD, DL-AGT and DL-AGT.<math>\beta</math>-CD inclusion complex from PXRD study.</p> <p><b>Table 3:</b> Chemical shifts and its deviations for the protons of <math>\beta</math>-CD, DL-AGT in free state and in inclusion complex</p> <p><b>Table 4:</b> Binding Affinity of DL-AGT and <math>\beta</math>-CD from molecular docking</p> <p><b>Table S1:</b> Job plot data of DL-AGT/<math>\beta</math>-CD system by UV-Visible spectroscopy (at 298.15K).</p> <p><b>Table S2:</b> Data of Benesi-Hildebrand double reciprocal plot for DL-AGT.<math>\beta</math>-CD system from UV-Visible spectroscopy at 293.15K.</p> <p><b>Table S3:</b> Data of Benesi-Hildebrand double reciprocal plot for DL-AGT.<math>\beta</math>-CD system from UV-Visible spectroscopy at 303.15K.</p> <p><b>Table S4:</b> Data of Benesi-Hildebrand double reciprocal plot for DL-AGT.<math>\beta</math>-CD system from UV-Visible spectroscopy at 313.15K.</p> <p><b>Table S5:</b> Solubility of DL-AGT and DL-AGT.<math>\beta</math>-CD in ethanol at 25°C.</p> | <b>117-120</b> |

| CHAPTERS            | TABLES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | PAGE NO.       |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <b>Chapter VIII</b> | <p><b>Table 1:</b> Details of Chemicals used</p> <p><b>Table 2:</b> Data for Job Plot performed by UV-Vis spectroscopy for ISD-<math>\beta</math>-CD system at 298.15K<sup>a</sup></p> <p><b>Table 3:</b> Data for the Benesi-Hildebrand double reciprocal plot performed by UV-VIS spectroscopic study for ISD-<math>\beta</math>-CD complex at 293.15 K</p> <p><b>Table 4:</b> Data for the Benesi-Hildebrand double reciprocal plot performed by UV-VIS spectroscopic study for ISD-<math>\beta</math>-CD systems at 303.15 K</p> <p><b>Table 5:</b> Data for the Benesi-Hildebrand double reciprocal plot performed by UV-VIS spectroscopic study for ISD-<math>\beta</math>-CD systems at 313.15 K</p> <p><b>Table 6:</b> Association constants obtained by the Benesi-Hildebrand method (<math>K_a</math>) from UV-Visible study, Fluorescence study and ITC study along with corresponding thermodynamic parameters of Indigosulfonic Acid dipotassium Salt-<math>\beta</math>-cyclodextrin inclusion complexes at 293.15K<sup>a</sup>, 303.15K<sup>a</sup> and 313.15K<sup>a</sup>.</p> <p><b>Table 7:</b> Data for calculation of Association Constant using fluorescence spectroscopic study</p> <p><b>Table 8:</b> Value indicating the Binding sites obtained from Isothermal Titration Calorimetric study.</p> <p><b>Table 9:</b> Data obtained from FT-IR spectroscopic study of <math>\beta</math>-CD, ISD and <math>\beta</math>-CD+ISD.</p> <p><b>Table 10:</b> The chemical shift values of <math>\beta</math>-CD, pure ISD and ISD-<math>\beta</math>-CD IC obtained from <sup>1</sup>H- NMR spectroscopy.</p> <p><b>Table 11:</b> Change in chemical shifts (ppm) of the H3 and H5 protons of <math>\beta</math>-cyclodextrin molecule in host-guest complexes in D<sub>2</sub>O.</p> | <b>140-144</b> |

## LIST OF FIGURES

| CHAPTERS          | FIGURES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | PAGE NO.      |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>Chapter IV</b> | <b>Fig 1:</b> Plot of <sup>1</sup> H NMR spectra of gallic acid (GA), uracil (UA) and uracil+ gallic acid (GU) at 298.15K in D <sub>2</sub> O.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>67-68</b>  |
| <b>Chapter V</b>  | <p><b>Fig.1.</b> (a) Spectra of Job's plot of AB.β-CD at λ<sub>max</sub>=212 nm, (b) Job plot of 1:1 stoichiometry where R=0.5; R= [Drug]/([Drug]+[CD])</p> <p><b>Fig. 2:</b> Benesi-Hildebrand double reciprocal plots of 1/ΔA against 1/β- [CD] at (a)293.15K, (b)303.15K and (c) 313.15 K.</p> <p><b>Fig. 3:</b> Plot of logk<sub>a</sub> Vs 1/T for the determination of thermodynamic parameters.</p> <p><b>Fig.4.</b> <sup>1</sup>H NMR spectra of pure Alibendol (top), pure β-CD (middle), AB - β-CD IC (bottom). (In d<sub>6</sub>-DMSO, 400 MHz)</p> <p><b>Fig 5:</b> 2D ROESY spectra of the solid IC of AB -β-CD in d<sub>6</sub>-DMSO. (Cross correlations are indicated by red circles)</p> <p><b>Fig.6.</b> FT-IR Spectra of (top) pure β -CD (middle) pure Alibendol and (bottom) AB . β-CD inclusion complex.</p> | <b>81-84</b>  |
| <b>Chapter VI</b> | <p><b>Figure 1 (a,b,c,d):</b> UV-vis spectra for the generation of Job plots of (a) AMH+α-CD and (b) AMH+β-CD systems and Job Plots of (c) AMH+α-CD and (d) AMH+β-CD systems at = 364 nm.</p> <p><b>Figure 2:</b> HRMS spectra of the AMH+α-CD Inclusion complex.</p> <p><b>Figure 3:</b> HRMS spectra of the AMH+β-CD Inclusion Complex.</p> <p><b>Figure 4:</b> Truncated structure of Cyclodextrins showing H<sub>3</sub> and H<sub>5</sub> protons of Cyclodextrins.</p> <p><b>Figure 5(a,b,c):</b> <sup>1</sup>H NMR spectra of (a) AMH+α-CD Inclusion complex, (b) AMH and (c) α-CD.</p>                                                                                                                                                                                                                                     | <b>99-105</b> |

| CHAPTERS           | FIGURES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | PAGE NO.       |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
|                    | <p><b>Figure 6(a,b,c):</b> <math>^1\text{H}</math> NMR spectra of (a) AMH+<math>\beta</math>-CD Inclusion complex, (b) AMH and (c) <math>\beta</math>-CD.</p> <p><b>Figure 7(a,b,c,d):</b> UV visible spectra (a) AMH+<math>\alpha</math>-CD, (b) AMH+<math>\beta</math>-CD) systems for the generation of Benesi Hildebrand double reciprocal plots of (c) AMH+<math>\alpha</math>-CD, (d) AMH+<math>\beta</math>-CD systems at 298.15K.</p> <p><b>Figure 8:</b> Optimized geometries for the (a) AMH+<math>\alpha</math>-CD (b) AMH+<math>\beta</math>-CD composite at M06-2X/6-31+G(d) level of theory. Red, gray, white, blue color represent oxygen, carbon, hydrogen, nitrogen atoms respectively.</p> <p><b>Figure 9:</b> Plots of reduced density gradient (RDG) for (a) AMH+<math>\alpha</math>-CD and (b) AMH+<math>\beta</math>-CD inclusion complexes.</p> <p><b>Figure 10(M-1, M-2, M-3, M-4, M-5):</b> Antimicrobial activity of (i) DMSO, (ii) AMH, (iii) AMH+<math>\alpha</math>-CD Inclusion complex, (iv) AMH+<math>\beta</math>-CD Inclusion complex against test organisms viz. <b>(M-1)</b> <i>B megaterium</i>, <b>(M-2)</b> <i>B Subtilis</i>, <b>(M-3)</b> <i>E Coli</i>, <b>(M-4)</b> <i>S aureus</i>, <b>(M-5)</b> <i>S typhimurium</i>. Antimicrobial potentiality was assessed at three different concentrations of each of the samples, viz. 100 <math>\mu\text{g}/\text{mL}</math>, 50 <math>\mu\text{g}/\text{mL}</math> and 25 <math>\mu\text{g}/\text{mL}</math>.</p> |                |
| <b>Chapter VII</b> | <p><b>Figure 1:</b> (a) Job plot for the stoichiometry 1:1 (Host:Guest) and (b) Spectra of Job's plot.</p> <p><b>Figure 2:</b> (A) UV spectra of DL-AGT.<math>\beta</math>-CD with different concentrations (<math>\text{g.L}^{-1}</math>) in ethanolic solution (at 298.15 K): (a) 0.033; (b) 0.066; (c) 0.099; (d) 0.132; (e) 0.165; (f) 0.198; (g) 0.228. (B) A plot of absorbance ratio of DL-AGT.<math>\beta</math>-CD at 238 nm vs. the concentration of DL-AGT.<math>\beta</math>-CD (inside the box)</p> <p><b>Figure 3:</b> PXRD diffractogram of (a) <math>\beta</math>-CD, (b) DL-AGT and (c) DL-AGT.<math>\beta</math>-CD IC (inclusion complex)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>120-126</b> |

| CHAPTERS            | FIGURES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PAGE NO.       |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
|                     | <p><b>Figure 4:</b> Infrared spectra of (a) <math>\beta</math>-CD, (b) DL-AGT and (c) <math>\beta</math>-CD.DL-AGT IC (Inclusion complex).</p> <p><b>Figure 5a:</b> <math>^1\text{H}</math> NMR spectra of (a) DL-AGT (b) <math>\beta</math>-CD and (c) <math>\beta</math>-CD.DL-AGT IC.</p> <p><b>Figure 5b:</b> ROESY spectrum of <math>\beta</math>-CD.DL-AGT IC in <math>\text{D}_6</math>-DMSO.</p> <p>Figure.6: Mode of binding of the drug DL-AGT into <math>\beta</math>-CD [IC] (a) Top view (b) Side view.</p> <p><b>Figure7:</b> SEM images of (A) DL-AGT (B) <math>\beta</math>-CD and (C) <math>\beta</math>-CD.DL-AGT IC.</p> <p><b>Figure8:</b> In-vitro cell viability study of pure drug and its Inclusion complex.</p> <p><b>Figure S1:</b> Benesi-Hildebrand double reciprocal plot at temperature 293.15K.</p> <p><b>Figure S2:</b> Benesi-Hildebrand double reciprocal plot at temperature 303.15K</p> <p><b>Figure S3:</b> Benesi-Hildebrand double reciprocal plot at temperature 313.15K.</p> <p><b>Figure S4:</b> Plot of <math>\log k_a</math> Vs <math>1/T</math> (from where the thermodynamic parameters were determined).</p> <p><b>Figure S5:</b> Absorption spectra of DL-AGT.<math>\beta</math>- CD inclusion complex with saturated concentration in ethanolic solution.</p> |                |
| <b>Chapter VIII</b> | <p><b>Fig.1:</b> Absorption spectra of intensity against wavelength obtained from UV-Visible spectroscopy at varying concentration of <math>\beta</math>-Cyclodextrin keeping the guest concentration (Indigosulfonic acid dipotassium salt) constant. The different lines represent absorption pattern at a particular concentration of <math>\beta</math>-CD.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>144-149</b> |

| CHAPTERS | FIGURES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | PAGE NO. |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|          | <p><b>Fig.2:</b> Job plot of <math>\beta</math>-Cyclodextrin (<math>\beta</math>-CD) and Indigosulfonic Acid dipotassium salt (ISD) system at <math>\lambda_{\max}</math> (Indigosulfonic Acid Dipotassium Salt) = 289 nm</p> <p><b>Fig.4:</b> Benesi-Hildebrand double reciprocal plot for the effect of <math>\beta</math>-CD on the absorbance of ISD at three different temperatures 293.15 K, 303.15 K and 313.15 K.</p> <p><b>Fig.5 :</b> Plot of <math>\log K_a</math> vs <math>1/T</math> for the interaction of <math>\beta</math>-CD with ISD.</p> <p><b>Fig.6:</b> Plot of <math>1/\Delta F</math> (<math>\Delta F</math> is the absorbance difference of guest in presence and absent of CD) Vs <math>1/[CD]</math> (<math>[CD]</math> is the concentration of CD) from the Stern-Volmer equation and fluorescence spectra of Indigosulfonic Acid Dipotassium salt and <math>\beta</math>-Cyclodextrin at different molar concentration.</p> <p><b>Fig.7:</b> Representative ITC(Isothermal Titration Calorimetry) profiles for the titration of ISD(Indigosulfonic Acid Dipotassium salt) (500mM) with <math>\beta</math>-CD (50 mM) at 298.15 K. figure above represent the raw data for the continuous injection of <math>\beta</math>-CDs(<math>\beta</math>-Cyclodextrin) into the ISD(Indigosulfonic Acid dipotassium Salt), after correction of heat of dilution. Figure below is the binding isotherm fitted to the raw data and the bottom panels show the integrated heat data after correction of heat of dilution.</p> <p><b>Fig.8:</b> FT-IR spectra of <math>\beta</math>-Cyclodextrin, pure Indigosulfonic acid dipotassium salt and ISD-<math>\beta</math>-Cyclodextrin inclusion complex.</p> <p><b>Fig.9:</b> <math>^1H</math> NMR spectra of <math>\beta</math>-Cyclodextrin, pure Indigosulfonic acid dipotassium salt and <math>\beta</math>-CD-ISD inclusion complex.</p> <p><b>Fig.10:</b> 2D NOESY NMR spectra of ISD-<math>\beta</math>-Cyclodextrin inclusion complex.</p> |          |

| CHAPTERS | FIGURES                                                                                                                                                                                                                                                                                                                                        | PAGE NO. |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|          | <p><b>Fig 11:</b> Structures of Indigosulfonic Acid Dipotassium Salt and <math>\beta</math>-Cyclodextrin and their schematic representation of inclusion.</p> <p><b>Fig.12:</b> SEM images of (A) pure <math>\beta</math>-Cyclodextrin, (B) pure Indigosulfonic acid Dipotassium Salt and (C) ISD.<math>\beta</math>-CD inclusion complex.</p> |          |

## LIST OF SCHEMES

| CHAPTERS           | SCHEMES                                                                                                                                                                                                           | PAGE NO.   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>Chapter IV</b>  | <b>Scheme 1.</b> Plausible solute-cosolute interaction C5 and C6 proton of uracil with phenolic OH group of gallic acid.                                                                                          | <b>68</b>  |
| <b>Chapter V</b>   | <b>Scheme 1.</b> Structures of the molecules.<br><b>Scheme 2.</b> Probable mechanism of inclusion.                                                                                                                | <b>85</b>  |
| <b>Chapter VI</b>  | <b>Scheme 1:</b> Molecular structures of $\alpha$ -cyclodextrin, $\beta$ -Cyclodextrin and Amiloride hydrochloride.<br><b>Scheme 2:</b> Formation of Inclusion complex through the wider rim of the cyclodextrin. | <b>106</b> |
| <b>Chapter VII</b> | <b>Scheme.1:</b> Structures of the concerned molecules.<br><b>Scheme.2:</b> The plausible mechanism of inclusion.                                                                                                 | <b>127</b> |

## **APPENDIX B**

### **List of Seminar/Conference/Workshop attended**

1. International Seminar on 'International Year of the Periodic Table of Chemical Elements-2019. 22<sup>nd</sup>-23<sup>rd</sup> November 2019. Organized by Dept. of Chemistry. University of North Bengal. **(Poster Presentation)**
2. SERB sponsored National Conference on 'Green Chemistry: An Alternative of Conventional Chemistry' Organized by: Dept of Chemistry, CBPBU, Cooch Behar, West Bengal, India In association with Indian Chemical Society, Kolkata. Co-Sponsored by: ANTON PAAR INDIA PVT. LTD Date:20<sup>th</sup>-21<sup>st</sup> September,2019. **(Poster Presentation)**
3. National Seminar on "Frontiers in Chemistry-2020" March 5, 2020, Organized by Dept. of Chemistry, University of North Bengal.
4. TWO DAYS NATIONAL WEB-BASED CONFERENCE ON "ENVIRONMENTAL DETERMINISM, DIVERSE POLLUTIONS, SOURCES AND CONTROLLING MANAGEMENT THROUGH SCIENCES AND HUMANITIES" .22<sup>nd</sup> and 23<sup>rd</sup> March, 2021. Organized by Alipurduar University. **(Oral Presentation)**