

## **DECLARATION**

I hereby declare that the thesis entitled "**Development of Biopolymeric Systems for the Controlled Delivery of Anti-Diabetic Agents**," submitted to the Department of Chemical Sciences, Tezpur University, under the School of Sciences, is a record of original research work carried out by me. All sources of support and assistance have been duly acknowledged. I also declare that neither this work as a whole nor any part of it has been submitted to any other University or Institute for any degree, diploma, or award.

*Dikshita Sharma*  
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Date: 12/08/2025

Place: Tezpur University, Tezpur



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## CERTIFICATE OF THE SUPERVISOR

This is to certify that the thesis entitled "*Development of Biopolymeric Systems for the Controlled Delivery of Anti-Diabetic Agents*", submitted to the School of Sciences, Tezpur University, in partial fulfilment for the award of the degree of Doctor of Philosophy in Chemical Sciences, is a record of research work carried out by **Ms. Dikshita Sharma** under my supervision and guidance. She has been duly registered (Registration No. TZU18997 of 2025), and the thesis presented is worthy of consideration for the PhD degree. All help received by her from various sources has been duly acknowledged. No part of this thesis has been submitted elsewhere for the award of any other degree.

*Tarun K. Maji*

Date: 12/08//2025

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## *Acknowledgements*

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*"My dear Krishna, O infallible one, my illusion is gone. I have regained my memory by Your mercy. I am now firm, free from doubt, and prepared to act according to Your instructions." — Bhagavad Gita.*

Guidance and wisdom from mentors can dispel the darkness of doubt, just as Arjuna experienced in the verse above. I have been fortunate to receive such unwavering support throughout my doctoral journey. I am grateful to acknowledge those who have guided, assisted, and inspired me in the completion of this thesis.

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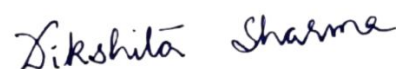
lab both productive and enjoyable. The unwavering support of everyone in the lab made it feel like a second home, and the memories we created together will always remain close to my heart.

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Above all, I sincerely thank the Almighty for the divine strength, grace, and guidance that have sustained me through every step of this journey. May this eternal presence continue to guide my path forward.

A handwritten signature in dark ink, reading "Dikshita Sharma". The script is cursive and fluid, with the first name "Dikshita" and the last name "Sharma" clearly distinguishable.

Dikshita Sharma

Date: 12/08//2025

Place: Tezpur University, Tezpur

## LIST OF TABLES

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Table No.	Table Title	Page No.
Table 3.1.	Effect of GA and MMT on properties of Lipoic Acid loaded Chitosan-Alginate complex	84
Table 3.2.	Effect of GA and HNT on properties of Lipoic Acid loaded Gelatin-Carrageenan complex	97
Table 3.3.	Effects of GA and MgO on the Properties of Curcumin-loaded Chitosan-Carrageenan Nanoparticles	108
Table 3.4.	Preparation of Curcumin-loaded MgO doped SF– MMT complex with different concentrations of MgO nanoparticles.	123
Table 3.5.	Preparation of Curcumin-loaded MgO doped SF– MMT complex with different concentrations of MMT nano-clay	124
Table 3.6.	Preparation of Curcumin-loaded MgO doped SF– MMT complex with different concentrations of cross-linker	124

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## LIST OF FIGURES

Figure No.	Figure Title	Page No.
Figure 1.1.	Structure of Curcumin	4
Figure 1.2.	Structure of $\alpha$ -Lipoic acid	5
Figure 1.3.	Pharmacokinetic profiles for immediate-release versus controlled-release dosage form	9
Figure 1.4.	Structure of Alginate	13
Figure 1.5.	Structure of different types of Carrageenan	15
Figure 1.6.	Structure of chitosan	18
Figure 1.7.	Amino Acid Composition of Gelatin	21
Figure 1.8.	Structure of Glutaraldehyde	33
Figure 1.9.	Structure of Tween 80	38
Figure 2.1.	Calibration curve of Lipoic Acid	70
Figure 2.2.	Calibration curve of Curcumin	71
Figure 3.1.	Effect of variation of concentration of GA and MMT on the percentage cumulative release of LA from the drug-loaded complex at pH 7.4 {(a2)CA, (b2)CA/M1, (c2)CA/M3, (d2) CA/GA1, (e2) CA/GA3, (f2)CA/GA2/M2} and pH 1.2{(a1) CA, (b1) CA/M1, (c1) CA/M3, (d1) CA/GA1, (e1) CA/GA3, (f1)CA/GA2/M2}	85
Figure 3.2.	FTIR spectra of (a)Alginate, (b) Lipoic Acid, (c) Chitosan, (d) CA	86
Figure 3.3.	FTIR spectra of (e) CA, (f) CA/GA1, (g) CA/GA3, (h) CA/GA2/M2	88
Figure 3.4.	FTIR spectra of (i) CA (j) CA/M1, (k) CA/M3, (l) MMT	88
Figure 3.5.	XRD Pattern of Lipoic Acid	89

Figure 3.6.	XRD patterns of (a) CA, (b) CA/GA1, (c) CA/GA3, (d) CA/M1, (e) CA/M3, (f) CA/GA2/M2	90
Figure 3.7.	SEM micrographs of (a) CA, (b) CA/GA1, (c) CA/GA3, (d) CA/M1, (e) CA/M3, (f) CA/GA2/M2	91
Figure 3.8.	Glucose uptake assay performed for (a) CA/GA2/M2, (b) CA/M3, (c) CA/M1, (d) CA/GA3, (e) CA/GA1, (f) CA, (g) Control, (h) Palmitate, (i) Insulin	92
Figure 3.9.	Cytotoxicity assay performed for the lipoic acid-loaded systems with varying concentrations of GA and MMT	94
Figure 3.10.	The cumulative drug release profile for (a) GC, (b) GC/M1, (c) GC/M2, (d) GC/M3, (e) GC/GA1, (f) GC/GA2, (g) GC/GA3, (h)GC/GA2/M2	98
Figure 3.11.	FTIR spectra of the product and the raw materials.	100
Figure 3.12.	XRD Pattern of Lipoic Acid and GC/GA2/H2	102
Figure 3.13.	FESEM images of (a) GC, (b) GC/GA1, (c) GC/GA3, (d) GC/M1, (e) GC/M3, (f)GC/GA2/M2	103
Figure 3.14.	Glucose uptake assay results for the samples	105
Figure 3.15.	Cytotoxicity assay performed for the lipoic acid-loaded GC systems with varying concentrations of GA and HNT	107
Figure 3.16.	The cumulative drug release profile for (a) CC, (b) CC/MO1, (c) CC/MO3, (d) CC/GA1, (e) CC/GA3, and (f) CC/GA2/MO2	109
Figure 3.17.	FTIR spectra of (a) Curcumin, (b) Carrageenan, (c) Chitosan, (d) CC complex, (e) CC/GA3, (f) CC/MO3, (g) CC/GA2/MO2	111
Figure 3.18.	XRD patterns of (a) MgO nanoparticles, (b) curcumin, (c) chitosan, (d) carrageenan, and (e) CC/GA2/MO2	113
Figure 3.19.	FESEM images of (a) CC, (b) CC/GA3, (c) CC/MO3, (d) CC/GA2/MO2	115



Figure 3.20.	EDX pattern of CC/GA2/MO2	117
Figure 3.21.	Analysis of 2-NBDG uptake by L6 myotubes in response to (a) Control, (b) Insulin, (c) Insulin + Palmitate, (d) CC/GA3, (e) CC/GA2, (f) CC/GA1, (g) CC, (h) CC/GA2/MO2, (i) CC/MO3, (j) CC/MO1, (k) CC/MO2, (l) Curcumin	118
Figure 3.22.	Cytotoxicity assay performed for the curcumin-loaded systems with varying concentrations of GA and MgO nanoparticles	121
Figure 3.23.	The cumulative drug release profile for different samples at pH =1.2 and pH=7.4	125
Figure 3.24.	FTIR spectra of (a) MgO nanoparticles, (b) MMT nano-clay, (c) Soy Flour, (d) Curcumin, (e) B0, (f) A0, (g) C0, (h) A3/B1/C4	127
Figure 3.25.	XRD pattern of (a) MgO nanoparticles, (b) Curcumin, (c) A3/B1/C4.	128
Figure 3.26.	FESEM images of (a) SF, (b) C0, (c) A0, (d) B0, (e) A3/B1/C4	130
Figure 3.27.	Analysis of 2-NBDG uptake by L6 myotubes in response to (a) Control, (b) Insulin, (c) Insulin + Palmitate, (d) A3/B1/C4, (e) C3, (f) C2, (g) C1, (h) C0, (i) B3, (j) B2, (k) B0, (l) A2, (m) A1, (n) A0, (o) Curcumin	131
Figure 3.28.	Cytotoxicity assay performed for the curcumin-loaded systems with varying concentrations of GA, MMT and MgO nanoparticles	133

## List of Abbreviations

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- **2-NBDG** – 2-(N-(7-nitrobenz-2-oxa-1,3-diazol-4-yl)amino)-2-deoxyglucose
- **ALA** –  $\alpha$ -Lipoic Acid
- **AMPK** – AMP-Activated Protein Kinase
- **ANOVA** – Analysis of Variance
- **BSA** – Bovine Serum Albumin
- **CA** – Chitosan-Alginate polyelectrolyte complex
- **CC** – Chitosan-Carrageenan complex
- **DDS** – Drug Delivery System
- **DM** – Diabetes Mellitus
- **DMEM** – Dulbecco's Modified Eagle Medium
- **DMSO** – Dimethyl Sulfoxide
- **EDX** – Energy Dispersive X-Ray Spectroscopy
- **EE** – Encapsulation Efficiency
- **FESEM** – Field Emission Scanning Electron Microscopy
- **FTIR** – Fourier-Transform Infrared Spectroscopy
- **GA** – Glutaraldehyde
- **GC** – Gelatin-Carrageenan complex
- **GDM** – Gestational Diabetes Mellitus
- **GLI** – Gliclazide
- **GLUT** – Glucose Transporter
- **GLUT-4** – Glucose Transporter Type 4
- **HNT** – Halloysite Nanotubes
- **KRP** – Krebs-Ringer Phosphate (buffer)
- **LA** – Lipoic Acid

- **LE** – Loading Efficiency (drug loading efficiency)
- **MMT** – Montmorillonite
- **MO** – Magnesium Oxide (in formulation codes)
- **MgO** – Magnesium Oxide
- **MTT** – 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide
- **NF- $\kappa$ B** – Nuclear Factor kappa B
- **NSAIDs** – Non-Steroidal Anti-Inflammatory Drugs
- **PBS** – Phosphate-Buffered Saline
- **PEC** – Polyelectrolyte Complex
- **PEG** – Polyethylene Glycol
- **PLA** – Polylactic Acid
- **PLGA** – Poly(lactic-co-glycolic) Acid
- **ROS** – Reactive Oxygen Species
- **SAFs** – Soy Protein-Derived Amyloid Fibrils
- **SAS** – Supercritical Antisolvent (technique)
- **SCF** – Supercritical Fluid (as in SCF technology)
- **SDS** – Sodium Dodecyl Sulfate
- **SEM** – Scanning Electron Microscopy
- **SF** – Soy Flour
- **SMEDDS** – Self-Microemulsifying Drug Delivery Systems
- **SPI** – Soy Protein Isolate
- **T1DM** – Type 1 Diabetes Mellitus
- **T2DM** – Type 2 Diabetes Mellitus
- **TEM** – Transmission Electron Microscopy
- **TPP** – Tripolyphosphate (sodium tripolyphosphate)
- **UV-Vis** – Ultraviolet-Visible, As In UV–Vis Spectroscopy
- **XRD** – X-Ray Diffraction