

*Dedicated to.....*

*My appa*

*Phurba Lepcha*

*who smiles at me from heaven above*

*And*

*aama*

*Roma Sunam Lepcha*

*who holds my hand and makes this journey worthwhile.*

## DECLARATION

I hereby declare that the thesis entitled “**Thermophilic lignocellulose deconstructing microbial consortium: Mining of cellulolytic glycoside hydrolases for saccharification of agro residues.**” is a genuine research work carried out by me in the Department of Biotechnology, University of North Bengal, Darjeeling- 734013, West Bengal, India, under the supervision of **Prof. (Dr.) Shilpi Ghosh**, Department of Biotechnology, University of North Bengal, Darjeeling- 734013, West Bengal, India.

I also affirm that the thesis is the original work and has not been submitted before in part or full for any other degree, diploma or academic award to this or any other University or Institution.

Place: *Siliguri*

Date: *21/12/2023*

*K. Lepcha 21/12/2023*  
Khusboo Lepcha, M.Sc.,

Department of Biotechnology, University of North Bengal,  
Darjeeling- 734013



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Prof. (Dr.) Shilpi Ghosh

### CERTIFICATE

This is to certify that Ms. Khusboo Lepcha has carried out her research work under my supervision in the department of Biotechnology, NBU. Her thesis entitled “**Thermophilic lignocellulose deconstructing microbial consortium: Mining of cellulolytic glycoside hydrolases for saccharification of agro residues.**” is based on her original work and is being submitted for the award of Ph.D. degree in Biotechnology in accordance with the rules and regulations of the University of North Bengal. No part of this thesis has formed the basis for the award of any other degree or fellowship previously.

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(Shilpi Ghosh)

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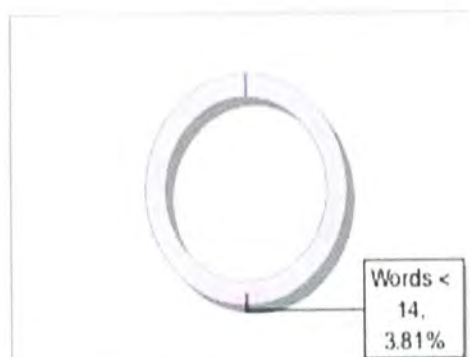
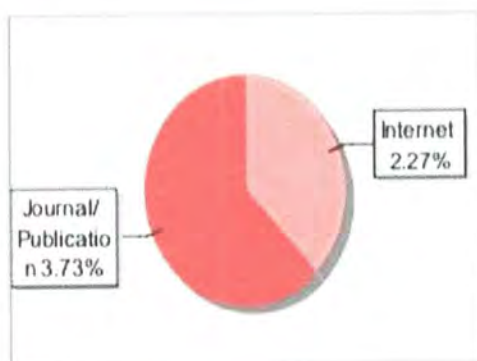
DR. SHILPI GHOSH  
Professor  
Department of Biotechnology  
University of North Bengal

### Submission Information

|                     |  |
|---------------------|--|
| Author Name         | Khusboo Lepcha   |
| Title               | Thermophilic lignocellulose deconstructing microbial consortium: mining of cellulolytic glycoside hydrolases for saccharification of agro residues |
| Paper/Submission ID | 1234606  |
| Submitted by        | nbuplg@nbu.ac.in   |
| Submission Date     | 2023-12-18 11:48:13  |
| Total Pages         | 85   |
| Document type       | Thesis   |

### Result Information

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### Exclude Information

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| Excluded Phrases              | Not Excluded |

### Database Selection

|                        |         |
|------------------------|---------|
| Language               | English |
| Student Papers         | Yes     |
| Journals & publishers  | Yes     |
| Internet or Web        | Yes     |
| Institution Repository | Yes     |



K. Lepcha  
21/12/2023

## ACKNOWLEDGEMENT

I take this opportunity to express my deepest gratitude and appreciation to the following individuals and institutions that have played a major role in the completion of this thesis and my research work.

I am immensely grateful to my mentor-supervisor, Dr. Shilpi Ghosh, Professor, Department of Biotechnology, University of North Bengal. I feel extremely privileged to have her as my supervisor, and I thank her with all my heart for believing in me and giving me the opportunity to work under her supervision when no one else believed in me. I thank her for inculcating in me the attitude of research and always being there for me to troubleshoot my problems during the research journey. Her insightful feedback and constructive criticism have significantly contributed in shaping this thesis. Her unwavering support throughout this research journey has been invaluable and I look up to her as my role model both professionally and personally.

I would also like to thank the Head of the Department, Dr. Ranadhir Chakraborty, Professor, Department of Biotechnology, University of North Bengal for his inspiring lectures, stimulating discussions, and for creating a conducive academic environment. The knowledge and skills I have gained from his teachings have been instrumental in the successful completion of this work. I am also deeply indebted to the faculty members of the Department, Dr. Dipanwita Saha, Professor, Dr. Anoop Kumar, Assistant Professor and Dr. Manab Deb Adhikary, Assistant Professor, Department of Biotechnology, University of North Bengal for their insights that have broadened my understanding of the subject.

I also gratefully acknowledge my senior colleagues at the Department of Microbiology, University of North Bengal, Dr. Arindam Bhattacharjee, Dr. Payel Sarkar, Dr. Sarita Kumari and Dr. Shyama Prasad Saha for their cooperation and support back at my work place. The non-teaching staffs of the department of Microbiology; Mrs. Madhumita Ghosh, Mr. Sudipto Das and Mr. Subir Sarkar are also gratefully acknowledged for always supporting me and creating a jovial environment in the department.

I would like to extend my heartfelt appreciation to the non-teaching staff of the department of Biotechnology, Mr. Raja Bauri, Mr. Deepak Das and Mr. Arup Ghosh whose assistance and resources have greatly facilitated my research. Their professionalism and willingness to assist have made my study more enriching and efficient.

Furthermore, I am extremely indebted to my labmates Ms. Vijeta Rai and Dr. Deepika Mazumdar for the gifts of sisterhood and friendship that I have received from them during this journey. Their intellectual exchanges and moral support have been a constant source of motivation during the challenging times. I extend my sincere appreciation to my seniors, friends, lab mates and juniors viz. Dr. Moushree Pal Roy, Ms. Madhumita Poddar, Dr. Vivek Ranjan, Ms. Aditi Rai, Dr. Preeti Mangar, Ms. Smriti Pradhan, Mr. Ayan Mahanty, Ms. Arijita Basak, Ms. Taniya Dey, Ms. Pooja BK, Ms. Satarupa Mullick, Ms. Subhasmita Chadra, Dr. Vaskar Das, Mr. Sudeb Sarkar, Ms. Divya Limbu, Ms. Nitya Rai, Mr. Partha Barman, and Ms. Chandana Basak who have provided me with continuous encouragement and support during my research

journey. I also thank all my students specially Mr Mahaarnab Saha, Mr.Bappaditya Mitra and Ms.Smriti Gazmer who took interest in my research and were a part of it.

I would like to acknowledge DST –INSPIRE fellowship for the financial support that I availed during the first few years of my journey. I also gratefully acknowledge University Departmental Research Assistance that I received for five years which allowed me to conduct the necessary experiments, analyze data, and present my findings at conferences. This support has been instrumental in the completion of this thesis. I also acknowledge USIC and COFAM, University of North Bengal for their contribution in my thesis.

All that I am today or ever hope to become, I owe to my benevolent and doting parents' Sri. Phurba Lepcha and Smt.Roma Sunam. There are no words to describe how much I love them and honor them. Their support, sacrifice and dedication have brought me to this stage of my life and their blessings will forever be the true jewels that adorn my life. I would also like to thank my friend and husband Andrew Roysten Rai for being my supporter and taking pride in my achievements. I specially thank him for respecting the choices that I made in life and being there by my side at my best and at my worst. When I count my blessing, I cannot be thankful enough to God Almighty for blessing me with my son Aankong Aaryoom Rai, who keeps me on my toes at all times yet has taught me the new definitions of strength, compassion and unconditional love.

I also gratefully acknowledge my Grandfather Mr.Bir Bahadur Sunam, Grandmother Mrs. Santa Sunam, my maternal family Mr.Chandrakumar Sunam, Ms. Saroj Sunam, Ms.Indira Sunam, Ms Premlata Sunam, Mr Rajen Kumar Pradhan, Ms. Rekha Sunam, Ms.Yashodha Sunam, Ms.Falmita Sunam and Mr. Norden Lepcha for being a part of my life. Their love and care have been instrumental in giving me beautiful childhood memories which shall be cherished throughout my life. I thank my cousins Ms. Pushpanjali Pradhan, Mr. Yash Raj Sunam, Ms Sanjukta Sunam and Mr Chinlop Lepcha for being a beautiful and fun –filled part of my life. I also gratefully acknowledge my Father in Law Mr. Hari Prasad Rai and my Mother in Law Mrs. Bimala Rai for their prayers, love, support and blessings. I also thank my Sisters in law Ms. Anusha Rai, Ms. Sajana Rai, Ms Ritchie Rai, Ms.Lisa Rai and the entire Rungmaangcha family for their love and support. I also acknowledge my friends Ms.Yankee Sherpa and Ms.Punyata Sundas who have loved and supported me like family during all stages of my life.

Finally, and above all, as I approach the finish line of this journey, I humbly bow down in reverence before God Almighty who has given me this life and chosen this journey for me. No matter how hard situations I had to face in life, he has held my hand and brought me out of it stronger and wiser. I dedicate my life to God Almighty and pray that all that I do only leads me towards finding and fulfilling my true purpose in life.

K. Lepcha  
21/12/2023

## PREFACE

Lignocellulose, a complex matrix of polymers comprising cellulose, hemicellulose, and lignin, represents the most abundant renewable biomass on Earth. Its intricate structure, however, poses a formidable challenge for effective utilization in various industries. The process of lignocellulose deconstruction involves breaking down these complex polymers into simpler components, such as sugars, that can be utilized for biofuel production, bioremediation, and other biotechnological applications. While physical and chemical methods have been employed for lignocellulose deconstruction, the use of microbial consortia, particularly bacterial consortia, has emerged as a promising and sustainable approach. Bacterial consortia are communities of different bacterial species working collaboratively to achieve a common goal. In the context of lignocellulose deconstruction, these consortia showcase a remarkable ability to synergistically break down the recalcitrant structure of plant biomass.

In the realm of biotechnology and industrial processes, the quest for efficient and versatile enzymes has been ceaseless. Heat-stable glycoside hydrolases, a class of enzymes involved in lignocellulose deconstruction, with the remarkable ability to withstand high temperatures, have emerged as invaluable tools in various applications from biofuel production to bioremediation. This study highlights the significance and diverse applications of heat-stable glycoside hydrolases produced from thermophilic bacterial consortia. The exploration of the mechanisms, challenges, and potential applications associated with lignocellulose deconstruction by bacterial consortia are covered in the following chapters. The enzymatic activities and expression profile of glycoside hydrolases involved in breakdown of lignocellulose have been studied and the significance of diversity within bacterial consortia and how it contributes to the efficiency and adaptability of lignocellulose degrading processes is also an important part of the study.

As research continues to unravel their intricacies, the applications of these enzymes are expected to expand, contributing to sustainable and efficient solutions in biotechnology and beyond. Despite the significant advancements in the field, challenges remain, such as optimizing enzyme production, enhancing substrate specificity, and further understanding the structure-function relationships. Future research endeavors will likely focus on the engineering of heat-stable glycoside hydrolases for improved performance in specific industrial processes and expanding their application horizons.

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