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.,

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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.

Date: 21/12/2023

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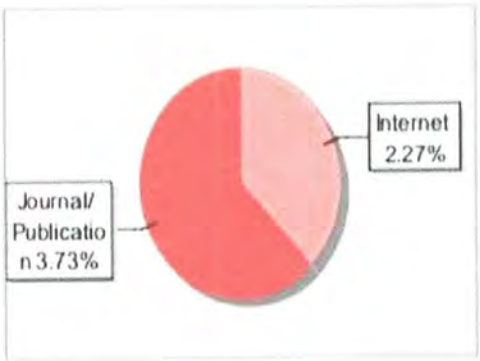

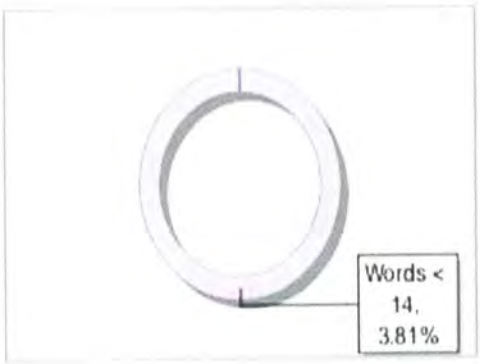

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K. Lepcha
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PREFACE

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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