Dedicated to

My Beloved

Parents, Sister, and Niece

Mr. Phouda Bahadur Bohora Chetry, Mrs. Asha Chetry,

Mrs. Anushree Kapila and Dityaa.

Thank you for your love, encouragement and support…

DECLARATION

I hereby declare that the thesis titled "***Fabrication and characterization of bio-based hybrid poly (vinyl alcohol)/carboxymethyl cellulose polymer films, reinforced with graphene oxide nanofiller for packaging applications***," submitted to the Department of Mechanical Engineering, Tezpur University, is an original piece of research carried out by me. All texts, figures, tables, and results that are not my own have been properly cited to acknowledge the original authors. All the sources of assistance received during the course of this work has been duly acknowledged. I further affirm that this work, in whole or in part, has not been submitted to any other University or Institution for the award of any degree, diploma, or similar qualification.

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CERTIFICATE OF THE SUPERVISOR

This is to certify that the thesis titled "***Fabrication and characterization of bio-based hybrid poly (vinyl alcohol)/carboxymethyl cellulose polymer films, reinforced with graphene oxide nanofiller for packaging applications***," submitted to the School of Engineering, Tezpur University in partial fulfillment of the requirements for the award of the degree of Doctor of Philosophy in Mechanical Engineering, is a bonafide record of original research carried out by **Mr. Karanjit Kapila** under my supervision and guidance.

All sources of assistance and support have been appropriately acknowledged.

I also certify that no part of this thesis has been submitted to any other institution or university for the award of any other degree or qualification.

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ACKNOWLEDGEMENTS

My thesis, titled **"Fabrication and Characterization of Bio-Based Hybrid Poly (Vinyl Alcohol)/ Carboxymethyl Cellulose Polymer Films, Reinforced with Graphene Oxide Nanofiller for Packaging Applications,"** would not have been possible without the invaluable support and contributions of many individuals.

First and foremost, I extend my heartfelt gratitude to my mentor and supervisor, Dr. Sushen Kirtania from the Department of Mechanical Engineering, Tezpur University. His mentorship, insightful guidance, patience, motivation, and unwavering support throughout the course of my research have been instrumental in shaping my academic journey.

I am also deeply grateful to Prof. Shambhu Nath Singh, Hon'ble Vice-Chancellor of Tezpur University, for granting me the necessary permissions and access to facilities that made this research possible.

My sincere thanks go to the esteemed members of my Doctoral Committee Prof. Pritam Deb, Dr. Satadru Kashyap, and Dr. Sanjib Banerjee for their valuable feedback, constructive suggestions, and continuous encouragement, all of which greatly enriched my research from multiple angles.

I would like to extend my heartfelt thanks to Prof. Tapan Kumar Gogoi, HoD, Department of Mechanical Engineering, Tezpur University, Doctoral Research Committee members and all the faculty and staff members of Mechanical Engineering Department, Prof. Sutanu Samanta, HoD, NERIST for their continuous support, thoughtful suggestions, and valuable insights, which greatly contributed to the shaping and refinement of this doctoral thesis.

I am also sincerely grateful to Prof. Laxmikant Shivnath Badwaik, Department of Food Engineering and Technology, Prof. Gazi Ameen Ahmed, Department of Physics, Tezpur University for generously granting me access to their laboratories and research facilities, which were essential for the successful execution of this research work.

I would like to acknowledge Mr. Jitu Mani Das, Assistant Librarian, Tezpur University, for his continuous cooperation during my thesis work and all the members of library.

I am indebted to the Research and Development Cell, Tezpur University, for facilitating financial assistance in the form of externally funded projects and fellowships. I would like to acknowledge Department of Food Engineering and Technology, Department

of Physics, Department of Molecular Biology and Biotechnology, Department of Chemical Sciences, SAIC, Tezpur University for granting me the access the research facilities. I would also like to express my sincere thanks to Indian Institute of Technology (IIT), Guwahati, Assam, for providing analysis facilities to carry out my research effectively.

I extend my heartfelt thanks to my fellow researchers for their collaborative spirit, insightful discussions, and shared enthusiasm. The collaborative and supportive atmosphere within the lab. truly fostered an environment of growth and innovation.

I also extend my heartfelt thanks to my hostel SCVRMH, all the members and menial staff members of hostel for their support throughout journey.

I thank my fellow research scholars, seniors, and friends Late. Dr. Pranjal Bora, Dr. Pulakesh Chetia, Dr. Sanjib Gogoi, Dr. Rajat Shubro Bose, Dr. Rewrewa Narzary, Dr. Barkhang Brahma, Dr. Manas Jyoti Das, Dr. Muzamil Ahmad Rather, Dr. Mukut Senapati, Dr. Joy Nondi, Dr. Pooja Dutta, Dr. Anindita Sharma, Ananda Ram Barman, Amdadul Mahmum, Achutish Borgohain, Raktim Jyoti Barpatra Gohain, Animesh Goswami, Ashraf Ali, Harjyoti Das, Mrinmoy Goutom Baruah, Abinash Kashyap Deka, Shahana Prabin, Faruq Aziz, Debanil Das, Neelab Sharma, Nikunja Nr. Kumar, Barbie Mech, Akuleti Sai Kumar, Dr. Lourembam Monica Devi, Dr. Amardeep Kumar, Kaushik Nath, Dr. Ritayaan Das, Manibhushan Kumar, Prashant Srivastav, Bidhan Das, Isfakur Rasul, Anjan Sharma, Mriganan M. Bordoloi, Kirubeil, TKM Sarwar, Dikshita Baruah for the academic collaborations and fun-filled discussions and support. I'd like to thank specially to Minu Thapa for all the love, support, and constant motivation.

Last but certainly not least, I would like to express my wholehearted gratitude to my family members, my colleagues, seniors, friends, juniors, family, and the Almighty for their unwavering blessings, support, encouragement, love, shared knowledge, and enthusiasm.

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

NP	Nanoparticle
NC	Nanocomposites
CNT	Carbon nanotubes
GO	Graphene oxide
rGO	Reduced graphene oxide
PVA	Polyvinyl alcohol
CMC	Carboxymethyl cellulose
FDA	Food and Drug Administration
GRAS	Generally recognized as a safe
RH	Relative humidity
ES	Electrospinning
TS	Tensile strength
EAB	Elongation at break
YM	Young's modulus
SEM	Scanning electron microscopy
TEM	Transmission electron microscopy
DSC	Differential Scanning Calorimetry
TGA	Thermogravimetric analysis
DTG	Derivative thermogravimetric
WVP	Water vapor permeability
WVTR	Water vapor transmission rate
WCA	Water contact angle
MRC	Moisture retention capacity
FTIR	Fourier Transform Infrared Spectroscopy
E. coli	*Escherichia coli*
S. aureus	*Staphylococcus aureus*
B. subtilis	*Bacillus subtilis*
P. putida	*Pseudomonas putida*