



Declaration by the Candidate

The thesis entitled "**Valorization of Pectin rich Assam lemon (*Citrus limon*) Peel Waste for Application in Food System**" is being submitted to **School of Engineering, Tezpur University** in partial fulfilment for the award of the degree of **Doctor of Philosophy** in the Department of Food Engineering and Technology is a record of bonafide research work accomplished by me under the supervision of **Dr Nishant R. Swami Hulle**.

All helps from various resources have been duly acknowledged.

No part of the thesis has been submitted elsewhere for the award of any other degree.

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Certificate of the Supervisor

This is to certify that the thesis entitled "**Valorization of Pectin rich Assam lemon (*Citrus limon*) Peel Waste for Application in Food System**" submitted to **School of Engineering, Tezpur University** in partial fulfilment for the award of the degree of **Doctor of Philosophy** in the Department of Food Engineering and Technology is a record of research work carried out by **Ms. Somya Singhal** under my supervision and guidance.

All helps from various resources have been duly acknowledged.

No part of the thesis has been submitted elsewhere for the award of any other degree.

Date: 04/08/2025

(Dr. Nishant R. Swami Hulle)

Place: Tezpur

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It takes a village to raise a child” is a well-known proverb, and I strongly believe that completing a PhD also requires the support of a village. I started my PhD just before the onset of the Covid-19 pandemic, a period that presented numerous challenges and uncertainties. Nonetheless, I made it to the finish line! I would like to express my deepest gratitude to the exceptional individuals who supported and guided me throughout this transformative journey, enabling me to successfully obtain my doctorate despite the many unforeseen obstacles that arose.

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LIST OF ABBREVIATIONS

Abbreviations	Full form
%	Percentage
°C	Degree Celsius
ANOVA	Analysis of Variance
AOAC	Association of Official Analytical Chemists
AU	Arbitrary Units
CE	Conventional extraction
DAc	Degree of acetylation
DE	Degree of Esterification
DM	Degree of methylation
DPPH	2,2-Diphenyl-1-picrylhydrazyl
DSC	Differential Scanning Colorimetry
EAE	Enzyme assisted extraction
FAO	Food and Agriculture Organization
FSSAI	Food Safety and Standards Authority of India
FTIR	Fourier Transform Infrared Spectroscopy
GAE	Gallic Acid Equivalent
GI	Glycaemic Index
HPAE	High Pressure Assisted Extraction
HG	Homogalacturonan
HMP	High methoxy pectin
ICP-OES	Inductively Coupled Plasma Optical Emission Spectrometry
LDPE	Low Density Polyethylene
LMP	Low methoxy pectin
MAE	Microwave-assisted extraction
Pa	Pascal
Pa.s	Pascal second
PIC	Pectin-iron complex

PL	Pineapple fruit leather
PME	Pectin Methyl Esterase
rad/s	Radian per second
RMSE	Root Mean Squared Error
RSA	Radical Scavenging Activity
RSM	Response Surface Methodology
RT	Room Temperature
SEM	Scanning Electron Microscopy
SLR	Solid-liquid ratio
TPC	Total phenolic content
TSS	Total Soluble Solids
UAE	Ultrasound-assisted extraction
UHPE	Ultra-High Pressure Extraction
WHO	World Health Organisation
XRD	X- Ray Diffraction