DECLARATION

I, hereby declare that this thesis entitled "**Ultrasound assisted supercritical CO_2 extraction of carotenoids from gac fruit**" is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Place: Tavanur **ASHITHA THOMAS**

Date: **(2022-18-004)**

CERTIFICATE

Certified that this thesis entitled "**Ultrasound assisted supercritical CO_2 extraction of carotenoids from gac fruit**" is a bonafide record of research work done independently by **Ms. Ashitha Thomas (2022-18-004)** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

Place: Thrissur
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We, the undersigned members of the advisory committee of **Ms. Ashitha Thomas (2022-18-004)** a candidate for the degree of Master of Technology in Agricultural Engineering with major in Processing and Food Engineering, agree that the thesis entitled "**Ultrasound assisted supercritical CO_2 extraction of carotenoids from gac fruit**" may be submitted by **Ms. Ashitha Thomas (2022-18-004)** in partial fulfilment of the requirement for the degree.

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ASHITHA THOMAS

Dedicated
to
My Beloved
Family, Teachers,
and Friends

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ABBREVIATIONS AND SYMBOLS

%	:	Percent
/	:	Per
+	:	Plus
<	:	Less than
>	:	Greater than
±	:	Plus or minus
a*	:	Greenness or redness
atm	:	Atmosphere
A_{crt}	:	Projected criteria area
b*	:	Blueness or yellowness
ρ_b	:	Bulk density
ºC	:	Degree Celsius
CO_2	:	Carbon dioxide
C	:	Chroma
CI	:	Colour Index
D_a	:	Arithmetic mean diameter
D_g	:	Geometric mean diameter
D_e	:	Equivalent diameter
D_r	:	Density ratio
cm	:	Centimeter
E	:	Elongation ratio
Fe^{2+}	:	Ferrous iron
f	:	Flakiness ratio
et al.	:	And others
h^0	:	Hue angle

h	:	Hour
Hz	:	Hertz
g/min	:	Gram per minute
J	:	Joule
J/kg·K	:	Joule per kilogram per Kelvin
k	:	Thermal conductivity
K	:	Kelvin
kHz	:	Kilohertz
kg/h	:	Kilogram per hour
kg/s	:	Kilogram per second
kJ/kg	:	Kilojoule per kilogram
kg/m^3	:	Kilogram per cubic meter
kJ/kg°C	:	Kilojoule per kilogram per degree Celsius
kV	:	kilovolt
kV/cm	:	Kilovolt per centimeter
l	:	Length
L	:	Litre
L*	:	Lightness or darkness
MHz	:	Megahertz
MPa	:	Megapascal
mm	:	Millimeter
nm	:	Nanometer
min	:	Minute
ml	:	Milli litre
mm^2	:	Square millimeters
mm^3	:	Cubic millimeters
L/min	:	Liter per minute
mL/min	:	Milliliter per minute
mm/sec	:	Millimeters per second
mg/mL	:	Micrograms per milliliter

μg/mL	:	Micrograms per milliliter
mg/100 g	:	Milligram per 100 grams
m^2/s	:	Square meter per second
μm	:	Micrometer
μl	:	Microliter
m_{pl}	:	Peel mass
m_{pu}	:	Pulp mass
m_{ar}	:	Aril mass
m_{se}	:	Seed mass
N	:	Newton
P_l	:	Projected area perpendicular to length
P_w	:	Projected area perpendicular to width
P_t	:	Projected area perpendicular to thickness
ε	:	Porosity
O_2	:	Oxygen
s	:	Seconds
C_P	:	Specific heat capacity
φ	:	Sphericity
V/cm	:	Volt per centimeter
v/v	:	Volume per volume
vol%	:	Volume percentage
w/w	:	Weight per weight
W/m°C	:	Watt per meter per degree Celsius
W/m·K	:	Watt per meter per Kelvin
w	:	Width
t	:	Thickness
α	:	Thermal diffusivity
ρ_t	:	True density

V_{ellp}	:	Ellipsoid volume
(V_{osv})	:	Oblate spheroid volume
AOAC	:	Association of official analytical chemists
AR	:	Aspect ratio
BSE	:	Backscattered Electrons
CCD	:	Central Composite Design
CER	:	Constant Extraction Region
CP	:	Cold Plasma
DBD	:	Dielectric Barrier Discharge
DC	:	Diffusion-Controlled region
DPPH	:	1,1-Diphenyl-2-picrylhydrazyl
DXS	:	1-dexosy-D-xylose-5-phosphate synthase
EA	:	Ethyl Acetate
EDS	:	Energy Dispersive X-ray Spectroscopy
EtOH	:	Ethanol
FER	:	Falling Extraction Region
FRAP	:	Ferric Reducing Antioxidant Power
FTIR	:	Fourier Transform Infrared Spectroscopy
HIPEF	:	High Intensity Pulsed Electric Field
HPE	:	High-Pressure Extraction
HPH	:	High Pressure Homogenization
HPLC	:	High Performance Liquid Chromatography
KAU	:	Kerala Agricultural University
KCAEFT	:	Kelappaji College of Agricultural Engineering and Food Technology
MAE	:	Microwave Assisted Extraction

MEP	:	Methylerythritol Phosphate
PEF	:	Pulse Electric Field
R^2	:	Coefficient of determination
RF	:	Radiofrequency
RSM	:	Response Surface Methodology
SA	:	Surface Area
SC-CO_2	:	Supercritical Carbon dioxide
SD	:	Standerd Deviation
SCW	:	Supercritical Water
SE	:	Secondary Electrons
SEE	:	Standard Error of Estimate
SEM	:	Scanning Electron Microscopy
SFE	:	Supercritical Fluid Extraction
SPT	:	Solubility Parameter Theory
TCR	:	Total Carotenoid Recovery
TPA	:	Texture Profile Analysis
TSS	:	Total Soluble Solids
UAE	:	Ultrasound Assisted Extraction
USC-CO_2	:	Ultrasound-assisted Supercritical Carbon dioxide