DECLARATION BY THE CANDIDATE

The candidate certifies that the thesis entitled "**Development of an Integrated Solar Greenhouse Dryer and Performance Evaluation for Ginger Drying in Northeastern Region of India**" is being submitted to **School of Engineering, Tezpur University** in part 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 accomplished by me under the supervision of Dr Manuj Kumar Hazarika, Professor, Department of Food Engineering and Technology.

All assistance received from various sources have been appropriately acknowledged.

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

Date: 30/11/2024

Place: Tezpur, Assam

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Certificate of the Supervisor

This is to certify that the thesis entitled "**Development of an Integrated Solar Greenhouse Dryer and Performance Evaluation for Ginger Drying in Northeastern Region of India**" submitted to the **School of Engineering, Tezpur University** in part 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 **Mr. Arun Kumar Choudhary** under my supervision and guidance.

All helps received by his from various sources have been duly acknowledged.

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

Signature of Supervisor

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Arun Kumar Choudhary

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Nomenclature

List of abbreviations

A	Area (m^2)
ANFIS	Adaptive Neuro Fuzzy Inference system
ANN	Artificial Neural Network
a, b, c	Model constant
C_a	Specific Heat in (J/kg)
CFD	Computational Fluid Dynamics
DR	Drying rate (kg water/kg dry matter*h)
E	Energy rate (W)
Ex	Exergy rate (W)
EPBT	Energy Payback Period (year)
I	Solar radiation (Wm^{-2})
ISGHD	Integrated Solar Greenhouse Drying system
L, a, b	Colorimetric parameters
L	Latent heat of fusion (J/kg)
MC	Moisture content (%)
MR	Moisture ratio dimensionless
M_0	Initial moisture content (kg water/kg dry matter)
Mt	Final moisture content (kg water/kg dry matter)
Me	Equilibrium moisture content (kg water/kg dry matter)
m_a	Mass flow rate of air (kg/s)
m_w	Mass of moisture (kg)
n	Model constants
N	Observations number
PCM	Phase Change Material
Q	Heat transfer rate (J/kg)
R^2	Coefficient of determination
R	Uncertainty function
RMSE	Root Mean Square Error
SAH	Solar Air Heating

SGHD	Solar Greenhouse Drying system
SEC	specific energy consumption (kWh/kg)
T	Temperature (°C)
t	Drying time (h)
ΔR	Total uncertainty

Greek symbols

η	Efficiency (%)
λ	Water latent heat of evaporation (J/kg)
χ^2	Chi-squared
τ	Transmissivity
α	Absorptivity

Subscripts

a	Air
amb	Ambient
ev	*Evaporation*
exp	experimental
ex	Exergy (W)
i	Inlet
o	Outlet
in	Inflow
out	Outflow
pre	Predicted