

Dedicated to.....

My beloved parents

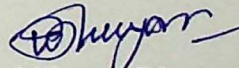
NILUTPAL



DECLARATION

I do hereby declare that the thesis entitled "*Fixed-bed Pyrolytic conversion of Tithonia diversifolia: Process Optimization, Catalytic Effects and Kinetic Study*", being submitted to the Department of Energy, Tezpur University, is a record of original research work carried out by me. All sources of assistance have been assigned due acknowledgment. I also declare that neither this work as a whole nor a part of it has been submitted to any other University or Institute for any other degree, diploma or award.

Place: Tezpur University, Tezpur


(Nilutpal Bhuyan)

Date: 25/12/2024



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CERTIFICATE

This is to certify that the thesis entitled "*Fixed-bed Pyrolytic conversion of Tithonia diversifolia: Process Optimization, Catalytic Effects and Kinetic Study*" submitted to the Tezpur University in the Department of Energy under the School of Engineering; in partial fulfillment for the award of the Degree of Doctor of Philosophy in Energy, has been examined by us on 25-12-2024 and found to be satisfactory.

The committee recommends for the award of the degree of Doctor of Philosophy.

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Sign. of External Examiner

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

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

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(Prof. Rupam Kataki)

Supervisor

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(Nilutpal Bhuyan)

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LIST OF ABBREVIATIONS

TD	<i>Tithonia diversifolia</i>
IEA	International Energy Agency
BET	Brunauer-Emmett-Teller
CV	Calorific Value
TGA	Thermogravimetric Analysis
DTG	Differential Thermogravimetric
FTIR	Fourier Transformed Infrared
FWO	Flynn-Wall-Ozawa
KAS	Kissinger Akahira Sunose
UNFCCC	United Nations Framework Convention on Climate Change
IRENA	International Renewable Energy Agency
CK	Combined Kinetic Model
NMR	Nuclear Magnetic Resonance
GC-MS	Gas chromatography-Mass spectrometry
GHG	Greenhouse Gas
IEO	International Energy Outlook
ICTAC	International Thermal Analysis and Calorimetry Society
VM	Volatile Matter
MC	Moisture Content
FC	Fixed Carbon
ANN	Artificial Neural Network
RSM	Response Surface Methodology
SEM	Scanning Electron Microscope
TGA	Thermogravimetric Analysis
TIC	Total Ion Chromatogram
XRD	X-ray Diffraction
EIA	Energy Information Administration

LM	Levenberg-Marquardt
MLP	Multi-Layer Perception
LEARNGD	Gradient Descent Learning Function
NIST	National Institute of Standards and Technology
STR	Starink
FRM	Friedman
VYZ	Vyazovkin
CCD	Central Composite Design
FTIR	Fourier Transform Infrared Spectroscopy
BJH	Barrett-Joyner-Halenda
BET	Brunauer-Emmett-Teller
EDX	Energy Dispersive X-ray spectroscopy
EC	Electrical Conductivity
R ²	Coefficient of Determination
RMSE	Root Mean Square Error
MAE	Mean Absolute Error
AAD	Absolute Average Deviation
SEP	Standard Error of Prediction
α	Fractional conversion
R	Gas constant
β	Heating Rate
A	Arrhenius constant
E _a	Activation energy
ΔS	Change in entropy
ΔG	Change in free energy
ΔH	Change in enthalpy