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I declare that this written submission represents my ideas in my own words and where other's ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty, integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be caused for disciplinary action as per the rules and regulations of the Institute.

Due acknowledgement to all the related data used from different sources in order to support my research findings have been made wherever necessary. All funding agencies have been duly acknowledged for providing research grants to carry out my research work smoothly.

Date: 28-07-2023

Place: Tezpur University

Debabrat Pathak

(Debabrat Pathak)

TZ156019 of 2015



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CERTIFICATE FROM SUPERVISOR

This is to certify that the thesis entitled "*Engineering Nitrogen-Rich Porous Organic Polymer as Heterogeneous Catalyst for Organic Transformation Reactions*" submitted to the School of Sciences, Tezpur University in partial fulfilment for the award of the degree of Doctor of Philosophy in Chemical Sciences is a record of research work carried out by **Mr. Debabrat Pathak** under my supervision and guidance. He has been duly registered (Registration No. TZ156019 of 2015), and the thesis presented is worthy of being considered for the Degree of Doctor of Philosophy.

All help received by him from various sources have been duly acknowledged. No part of the thesis has been submitted elsewhere for award of any other degree.

(Dr. Bipul Ch. Sarma)

Supervisor

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CERTIFICATE OF THE EXTERNAL EXAMINER AND ODEC

The examiners of Oral Defense Examination Committee (ODEC) certify that the thesis entitled "*Engineering Nitrogen-Rich Porous Organic Polymer as Heterogeneous Catalyst for Organic Transformation Reactions*" submitted by **Mr. Debabrat Pathak** to the School of Science, Tezpur University in partial fulfilment for the award of the degree of Doctor of Philosophy in the discipline of Chemical Sciences has been examined on 22nd of December, 2023 and recommended that the degree be awarded.

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External Examiner

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Abbreviations and Symbols

%	Percentage
δ	Chemical shift
J	Coupling constant
$^{\circ}\text{C}$	Degree celsius
λ	Wavelength
\AA	Angstrom
$^{\circ}$	Degree
θ	Diffraction angle
AAS	Atomic absorption spectroscopy
atm	Atmospheric pressure
a. u.	Arbitrary unit
BET	Brunner-Emmett-Teller
BJH	Barrett-Joyner-Halenda
Bn	Benzyl
COF	Covalent organic framework
CCDC	Cambridge crystallographic data center
calcd	Calculated
CDCl_3	Deuterated chloroform
CMP	Conjugated microporous polymer
Cs_2CO_3	Cesium carbonate
CTF	Covalent triazine framework
dd	Doublet of doublet
ddd	Doublet of doublet of doublet
DBU	1,8-Diazabicyclo[5.4.0]undec-7-ene
DMAP	4-Dimethylaminopyridine
DMSO	Dimethylsulfoxide
DMF	<i>N,N</i> -dimethylformamide
DCM	Dichloromethane
$\text{DMSO-}d_6$	Deuterated dimethylsulfoxide
EDX	Energy dispersive X-ray
Equiv	Equivalent
EI-MS	Electron ionization mass spectrometry

ESI-MS	Electron spray ionization mass spectrometry
ESI-QTOF	Electron spray ionization quadrupole time-of-flight
eV	Electronvolt
Fg ⁻¹	Faraday per gram
FESEM	Field emission scanning electron microscope
FT-IR	Fourier transformed infra-red spectroscopy
g	gram
HCP	Hyper cross-linked polymer
HRMS	High resolution mass spectrometry
HR-TEM	High resolution – transmission electron microscope
h	hour(s)
IM	Intermediate(s)
ICP-OES	Inductively coupled plasma optical emission spectrometry
K	Kelvin (temperature unit)
kV	Kilovolt
KO ^t Bu	Potassium <i>tert</i> -butoxide
LUMO	Lowest unoccupied molecular orbital
m ²	Square meter
MeOH	Methanol
mmol	Milli mole(s)
MHz	Mega-Hertz
MOF	Metal organic framework
MOP	Microporous organic polymer
m	Multiplet
min	Minute
mg	Milli gram(s)
mL	Milli litre(s)
mol%	Mole percentage
<i>m/z</i>	Atomic mass units per unit charge
mp	Melting point
Me	Methyl
MeCN	Acetonitrile
NMR	Nuclear magnetic resonance
nr	No reaction

<i>n</i> -Bu	<i>n</i> -butyl
OC	Organic carbon
ORTEP	Oak ridge thermal ellipsoid plot
P ₀	Saturated pressure of adsorbate gas (in Pascals)
Ph	Phenyl
PAF	Porous aromatic framework
PIM	Polymers with intrinsic microporosity
POP	Porous organic polymer
ppm	Parts per million
PTSA	<i>p</i> -Toluene sulfonic acid
PXRD	Powder X-ray diffraction
q	Quartet
r.t.	Room temperature
s	Singlet
SEM	Scanning electron microscope
SEM-EDX	Scanning electron microscope energy dispersive X-ray
SCXRD	Single crystal X-ray diffraction
<i>t</i>	Triplet
T	Temperature
TBHP	<i>tert</i> -Butyl hydroperoxide
<i>t</i> -BuOH	<i>tert</i> -Butanol
TGA	Thermogravimetric analysis
TEM	Transmission electron microscope
THF	Tetrahydrofuran
TLC	Thin layer chromatography
TMS	Tetramethylsilane
TEMPO	(2,2,6,6-tetramethylpiperidin-1-yl)oxyl
TNT	2,4,6-Trinitrotoluene
UV-Vis	Ultra violet-visible
UV-Vis DRS	Ultra violet-visible diffuse reflectance spectroscopy
v/v	Volume/volume
wt%	Weight percentage
w.r.t	with respect to
XPS	X-ray photoelectron spectroscopy