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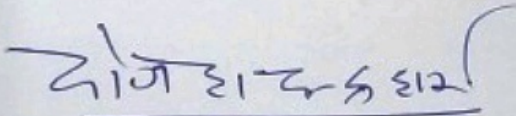
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This is to certify that the revised thesis entitled "*Synthesis of biodiesel using indigenous feedstocks and effect of co-solvent on biodiesel yield*" submitted by *Mr. Devarapaga Madhu* in partial fulfillment for the award of Ph.D. in Department of **Chemistry** IIT(BHU), Varanasi is a record of bonafide work carried out by him.

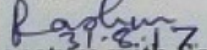
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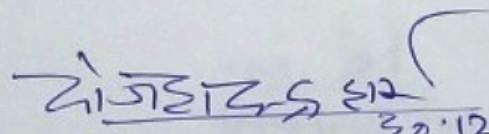
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It is further certified that the student has fulfilled all the requirements of Comprehensive, Candidacy and SOTA.

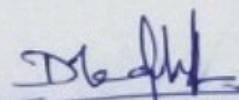

30.12.2016

Prof. Yogesh Chandra Sharma
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DECLARATION BY THE CANDIDATE

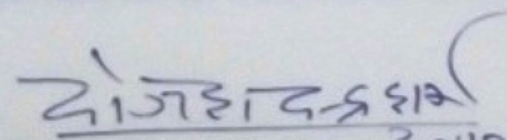
I, **Devarapaga Madhu** certify that the work embodied in this thesis is my own bonafide work and carried out by me under the supervision of **Prof. Yogesh Chandra Sharma** from **July 2014 to December 2016** at the **Department of Chemistry**, Indian Institute of Technology, Banaras Hindu University, Varanasi. The matter embodied in this thesis has not been submitted for the award of any other degree/diploma. I declare that I have faithfully acknowledged and given credits to the research workers wherever their works have been cited in my work in this thesis. I further declare that I have not willfully copied any other's work, paragraphs, text, data, results, etc., reported in journals, books, magazines, reports, dissertations, theses, etc., or available at websites and have not included them in this thesis and have not cited as my own work.

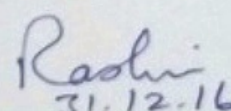
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It is certified that the above statement made by the student is correct to the best of my knowledge.


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Prof. Yogesh C. Sharma
(Supervisor)
Department of Chemistry,
IIT(BHU), Varanasi


31.12.16
Prof. R.B. Rastogi
(Head)
Department of Chemistry,
IIT(BHU), Varanasi
विभागाध्यक्ष/HEAD
रसायन विज्ञान विभाग
Department of Chemistry
भारतीय प्रौद्योगिकी संस्थान (का.हि.वि.वि.)
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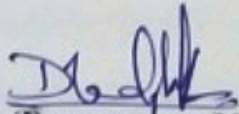
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ABBREVIATIONS

$^{\circ}\text{C}$	Degree centigrade
μ	Micro
\AA	Angstrom
ν	Frequency
$^{\circ}$	Degree for measurement of plane angle
cm^3/g	Centimeter cubed per gram
Conc.	Concentration
Ca.	Circa or approximately
cm^{-1}	Wavenumber
DTA	Differential thermal analysis
eV	Electron volt
g	Gram
h	Hour
kg	Kilogram
mg	Milligram
min	Minute
mole	Mole
kJmol^{-1}	Kilo Joule per mole
r	Radius per minute
SEM	Scanning electron microscope
t	Time
T	Temperature
V	Volume
FTIR	Fourier transform infrared spectroscopy
W	Weight
XRD	X-ray photoelectron spectroscopy
rpm	Rotation per minute
EDX	Energy dispersive X-ray
EDX	Kelvin
GC-MS	Gas chromatography-mass spectrometry
NMR	Nuclear magnetic resonance
THF	Tetrahydrofuran
mg KOH/g	Milligrams of potassium hydroxide per gram
RT	Retention time

m/z	Mass to charge ratio
θ	Plane angle
θ/s	Plane angle per second
λ	Wavelength of X-ray
ASTM	American Society for Testing and Material
B 20	20 % biodiesel blended with 80 % mineral diesel
B 100	100 % biodiesel
C	Conversion
FFA	Free fatty acids
MTOE	Million tonnes of oil equivalent
v/v	Volume/volume
w/v	Weight/volume
wt %	Weight percent
Y	Yield
mb/pd	Million barrel per day
Btu	British thermal unit
mm²/s	Square millimeter per second
g/cm³	Gram per cubic centime
TCP	Tricalcium phosphate