

**Carbon Support based Heterogeneous Catalysts
for Sustainable Synthesis of Indole
Alkaloids and Chromenes**

A thesis
submitted by

**Ashish Bahuguna
(D13007)**

for the award of the degree of
Doctor of Philosophy



**School of Basic Sciences
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Dedicated

To

My beloved

Mother and Father

(म्येरा प्रिय माँ और पिताजी तैं समर्पित)



INDIAN INSTITUTE OF TECHNOLOGY MANDI

MANDI- 175 005 (H.P.), INDIA

www.iitmandi.ac.in

Declaration by the Research Scholar

I hereby declare that the entire work embodied in this Thesis is the result of investigations carried out by me in the **School of Basic Sciences**, Indian Institute of Technology Mandi, under the supervision of **Dr. Venkata Krishnan**, and that it has not been submitted elsewhere for any degree or diploma. In keeping with the general practice, due acknowledgements have been made wherever the work described is based on finding of other investigators.

Place: Mandi, Himachal Pradesh, INDIA

Date: Jan. 11, 2019

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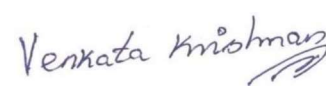
Name: Ashish Bahuguna

Declaration by the Research Advisor

I hereby certify that the entire work in this Thesis has been carried out by **Mr. Ashish Bahuguna**, under my supervision in the **School of Basic Sciences**, Indian Institute of Technology Mandi, and that no part of it has been submitted elsewhere for any Degree or Diploma.

Place: Mandi, Himachal Pradesh, INDIA

Date: Jan. 11, 2019

Signature: 

Name: Dr. Venkata Krishnan

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Abbreviations

AE.....	Atom economy
ACN.....	Acetonitrile
BET.....	Brunauer-Emmett-Teller
DCM.....	Dichloromethane
DMC.....	Dimethyl carbonate
DMSO.....	Dimethyl sulfoxide
DNA.....	Deoxyribose nucleic acid
EDAX.....	Energy-dispersive X-ray analysis
EtOAc.....	Ethyl acetate
EtOH.....	Ethanol
FESEM.....	Field emission scanning electron microscopy
GCN.....	Graphitic carbon nitride
GO	Graphene oxide
HRMS.....	High resolution mass spectrometry
HRTEM.....	High resolution transmission electron microscopy
IPA.....	Isopropyl Alcohol
IR.....	Infrared
M.P.....	Melting point
NMR.....	Nuclear magnetic resonance
PANI.....	Polyaniline
PME.....	Process mass intensity
RGO.....	Reduced graphene oxide
SAR.....	Structure activity relationship
RME.....	Reaction mass efficiency
TGA.....	Thermogravimetric analysis
TLC.....	Thin layer chromatography
UV.....	Ultraviolet
Vis.....	Visible
XRD.....	X-ray diffraction
XPS.....	X-ray photoelectron spectroscopy

Table of Contents

Chapter 1. Introduction	1
1.1. Importance of work	2
1.2. Aims and objectives	3
1.3. References	3
Chapter 2. Literature Review	6
Abstract	7
2.1. Introduction	8
2.2. Synthesis of carbon based materials	10
2.2.1. Synthesis of graphene based materials	11
2.2.2. Synthesis of graphitic carbon nitride based materials	14
2.2.3. Synthesis of carbon nanotubes based materials	17
2.2.4. Synthesis of activated carbon based materials	18
2.3. Graphene based materials for heterogeneous catalysis	20
2.3.1. Graphene support based materials	20
2.3.2. Graphene oxide support based materials	23
2.3.3. Reduced graphene oxide support based materials	36
2.4. Graphitic carbon nitride (GCN) based materials for heterogeneous catalysis	46
2.4.1. GCN as metal free catalyst for heterogeneous catalysis	47
2.4.2. GCN as catalyst support for organic transformations	50
2.5. Carbon nanotubes (CNT) as support for heterogeneous catalysis	58
2.6. Activated carbon (AC) as support for heterogeneous catalysis	68
2.7. Summary	74
2.8. References	75
Chapter 3. Reduced Graphene Oxide Support based Nanocomposites	95
Abstract	96
3.1. Nanohybrid of ZnO-RGO as heterogeneous Green catalyst	97
3.1.1. Synthesis and characterization of catalysts	97
3.1.2. Catalytic activity studies	99
3.1.3. Experimental section	105

3.2. Nanocomposites of MoS ₂ -RGO as sustainable heterogeneous catalyst	106
3.2.1. Synthesis and characterization of catalysts	107
3.2.2. Catalytic activity studies	113
3.2.3. Experimental section	122
3.3. Medicinal activity studies	134
3.4. References	140
Chapter 4. Graphitic Carbon Nitride Support based Nanocomposites	147
Abstract	148
4.1. MoS ₂ -GCN nanocomposites for heterogeneous catalysis	149
4.1.1. Synthesis and characterization of nanocomposites	149
4.1.2. Catalytic activity studies	155
4.1.3. Experimental section	164
4.2. Ammonia-doped PANI-GCN nanocomposites	172
4.2.1. Synthesis and characterization of nanocomposites	174
4.2.2. Catalytic activity studies	181
4.2.3. Experimental section	191
4.3. References	200
Chapter 5. Functionalized GCN Supported over RGO Nanocomposites	209
Abstract	210
5.1. Functionalized GCN on RGO as heterogeneous catalyst	211
5.1.1. Synthesis and characterization of nanocomposites	212
5.1.2. Catalytic activity studies	220
5.1.3. Experimental section	231
5.2. References	238
Chapter 6. Summary and future perspectives	242
6.1. Summary	243
6.2. Future perspectives	245
Appendix	246
List of publications	263