

**Zinc Oxide Supported on Two Dimensional Materials as
Heterogeneous Photocatalysts for Energy Conversion
and Environmental Remediation Applications**

A thesis
submitted by

**Suneel Kumar
(D14013)**

for the award of the degree of
Doctor of Philosophy



**School of Basic Sciences
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Dedicated to Lord Shiva

and

My Beloved Parents





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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.

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Declaration by the Research Advisor

I hereby certify that the entire work in this thesis has been carried out by **Mr. Suneel Kumar**, 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

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Name: Dr. Venkata Krishnan

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Abbreviations

BET.....	Brunauer-Emmett-Teller
BQ.....	Benzoquinone
CZ.....	Carbendazim
DRS.....	Diffuse reflectance spectroscopy
EDAX.....	Energy-dispersive X-ray analysis
FESEM.....	Field emission scanning electron microscopy
FTIR.....	Fourier-transform infrared spectroscopy
GO.....	Graphene oxide
HRMS.....	High resolution mass spectrometry
HRTEM.....	High resolution transmission electron microscopy
ITO.....	Indium doped tin-oxide
LSV.....	Linear sweep voltammetry
MB.....	Methylene blue
MNF.....	Molybdenum disulfide nanoflowers
NB.....	Nitrobenzene
NP.....	Nanoparticles
NR.....	Nanorods
NS.....	Nanosheets
PEC.....	Photoelectrochemical cell
PTFE.....	Polytetrafluoroethylene
RGO.....	Reduced graphene oxide
RhB.....	Rhodamine B
TBZ.....	Thiabendazole
TC.....	Tetracycline
TEA.....	Triethanolamine
TGA.....	Thermogravimetric analysis
TOC.....	Total organic carbon
UV.....	Ultraviolet
XRD.....	X-ray diffraction
XPS.....	X-ray photoelectron spectroscopy

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