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Dedicated

to

My Beloved
Parents
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ABBREVIATIONS

AFM Atomic Force Microscope
Ar-OH Phenol
ATRP Atom Transfer Radical Polymerization
C. Callicarpa
CNM Carbon Nanomaterials
CNT Carbon Nanotubes
CPT Camptothecin
DCC N,N’-dicyclohexylcarbodiimide
DEPT Distortionless Enhancement by Polarization Enhancement
DFT Density Functional Theory
DI Deionized
DMAP 4-Dimethylaminopyridine
DMF Dimethylformamide
DMSO Dimethyl Sulfoxide
DNA Deoxyribonucleic Acid
DOX Doxorubicin
EPR Enhanced Permeability and Retention
EO Essential Oil
FT-IR Infrared Spectroscopy
GAE Gallic Acid Equivalent
GC Gas Chromatography
GC-MS Gas Chromatography-Mass Spectrometry
GNP Graphene Nanoplate
GNS Graphene Nanosheet
GO Graphene Oxide
HOMO Highest Occupied Molecular Orbital
IC_{50} Inhibitory Concentration
IR Infrared Spectroscopy
J. Juniperus
LUMO Lowest Occupied Molecular Orbital
Me-OH Methanol
NMR Nuclear Magnetic Resonance
NPs Nanoparticles
PEG Polyethylene Glycol
PNIPAM Poly(N-isopropylacrylamide)
PTFE Polytetrafluoroethylene
PVA Polyvinyl Alcohol
QSR Quercetin
RAFT Reversible Addition Fragmentation Chain Transfer Polymerization
RGO Reduced Graphene Oxide
RNA Ribonucleic Acid
ROP Ring-Opening Polymerization
SWNT Single Wall Carbon Nanotube
Tf Transferring
TFC Total Flavonoids Content
TLC Thin Layer Chromatography
TMS Tetra Methyl Silane
TPC Total Phenolic Content
PREFACE

Contemporary research works demonstrate a trend for a transition, accepting challenges more of interdisciplinary nature. It is an era of science where different streams have joined their hands together to address key challenges of the contemporary world. This research work is one such attempt where an effort has been made to create new horizon by merging Natural Products and Nanotechnology. World has witnessed dependency of human beings on Natural Products as an effective measure to treat numerous ailments for centuries. Undoubtedly, Natural Products have occupied no less space in our day to day life but there are certain inherent drawbacks associated with them owing to their atomic organization. Retarded solubility in biological atmosphere is indisputably one of them. It inhibits their pharmaceutical action and restricts their wider application in modern pharmaceutics. Carbon nanomaterials (CNMs) have provided us an opportunity to impart artificial solubility in these biologically active compounds along with providing high cellular permeability. The modification of different nanomaterials and their surface at the nano scale has been exploited in recent decades especially by nano chemists and technologists. The synthesis of CNMs and alteration of their surface provides an opportunity to impart artificial solubility in water insoluble moieties. This research work is dedicated to phytochemical screening of two medicinally important plants viz. *C. vestita* and *J. squamata*, collected from Kumaun Himalayas. Water insoluble isolate of *C. vestita* has been investigated for its pharmaceutical potential against selected cancer cell lines. Therapeutic action of isolate was enhanced by developing Graphene Oxide based nanocarriers. This nanocarrier has been developed by combining large surface area containing Graphene Oxide sheets with hydrophilic polymer PVA. The large surface of the nano carrier was exploited for the efficient loading and delivery of the isolate inside the cancer cell lines. This innovative attempt has assured enhanced pharmacological effect of water insoluble molecule inside the biological atmosphere. This research work proposes a reliable alternative to deliver such water insoluble molecules to the biological atmosphere with an enhanced pharmaceutical action.

The thesis has been divided into Five Chapters, a short description of these Chapters has been mentioned below.

The first Chapter of the thesis puts light on recent research trends, emphasizing more on carbon nanomaterials based drug delivery and use of natural products in the synthesis of nanoparticles. The Chapter also deals with concise introduction and literature review of the proposed plants.

The second Chapter deals with phytochemical screening of *C. vestita*. In this Chapter EO and plant extract have been evaluated by various spectroscopic techniques. The terpenoid profile of the EO has been evaluated by the help of GC and GC-MS techniques, and the structural elucidation of the isolate from root extract was done with the help of various spectroscopic techniques.
The third Chapter elaborates phytochemical screening of *J. squamata*. In this Chapter EO of leaves and berries and plant extract have been evaluated by various spectroscopic techniques. The terpenoid profile of the EO of *Juniper* berries and leave has been evaluated by the help of GC and GC-MS techniques, and the structural elucidation of the isolate from root extract was done with the help of various spectroscopic techniques. The berries EO was used to establish chemotaxonomic status of the plant.

The fourth Chapter covers the synthesis of Graphene Oxide and its characterization. The synthesized GO was later used in order to develop nanocarriers for the isolate by surface revamping. This Chapter also discusses loading of isolate from the *C. vestita* on to the nanocarriers. Characterization of GO, its functionalization with hydrophilic polymer and loading of isolate was confirmed by various techniques such as AFM, Raman, FT-IR and UV spectrometry.

The last Chapter of the thesis discusses drug delivery potential of the developed nanocarriers against selected cancer cell lines. In addition, antimicrobial activities of the EO of *C. vestita, J. squamata* has also been undertaken in this Chapter of the thesis.