

KAKATIYA GOVERNMENT COLLEGE
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S. No.	Details of copies of Certificates	
1	Copy of Ph.D Certificate	Yet to receive (Applied)
2	Press note	Enclosed
3	Research work dates of seminars and Pre-Ph.D Date of joining in this college 30-06-2018	Enclosed
4	Details of Ph.D Admission-part time or full time Part Time - 31-03-2017	Enclosed
5	Copies of RDC Approval letters of Ph.D	Enclosed
6	Name of guide/supervisors with mobile number, email id Prof. Karuna Rupula, 9441901161, Karunarupula@osmania.ac.in	Enclosed
7	Copies of guide allotment letter	Enclosed
8	No. of increments sanctioned for Ph.D.	Not Yet Sanctioned
9	Published Research article-copies.	Enclosed
10	Original Ph.D Thesis.- Book.	Available at office




Dr. R. Shyamala Chandra
 Asst. Professor
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CONFIDENTIAL SECTION
EXAMINATION BRANCH
NO. 836/Ph.D/Exams/2024

OSMANIA UNIVERSITY
HYDERABAD-500 007,T.S.
Dated: 21 Mar, 2024

PRESS NOTE

The following candidates who had presented the Thesis on the subject mentioned against each for the degree of Ph.D are declared qualified for the award of Degree of Doctor of Philosophy (Ph.D.) of Osmania University, Hyderabad.

Ph.D.

S.N	Reference No.	Name of the Candidate/ Father Name	Subject	Thesis Title	Supervisor/ Regn. Date
1	PHD44844	Ms. Swetha Kalakuntla D/o. Thirupathi	Physics	Study on the Effect of Manganese Non-Stoichiometry and Additives on Magnetic and Magneto-Transport Behaviour of $La_{0.67}Sr_{0.33}MnO_3$ Manganites	Dr. Y Kalyana Lakshmi Asst. Professor, Dept. of Physics, O.U., Hyd. (16/03/2017)
2	PHD44845	Mr. Raja Shekhar Katla S/o. Poshalu	Physics	Investigation of Structural, Magnetic and Electrical Properties of Rare Earth Doped Ni-Cu Nanoferrites	Prof. J Laxman Naik Dept. of Physics, O.U., Hyd. (07/09/2018)
3	PHD44846	Ms. Nampally Sabitha D/c. Laxmaiah	Physics	Studies on the Point Spread Functions of Aberrated Optical Systems with Defect-of-Focus Performance	Prof. D Karuna Sagar Dept. of Physics, O.U., Hyd. (06/09/2018)
4	PHD44847	Mr. B Arun Kumar S/o. B Anjaneyulu	Commerce	Evaluation of Pension Fund Managers of National Pension System in India - A Comparative Study	Prof. Jasti Ravi Kumar Dept. of Commerce, O.U., Hyd./Co-Supervisor: Prof. S Sreenivasa Murthy, Director, IPE, Hyd. (13/03/2017)
5	PHD44848	Ms. Rokkal Shyamala Chandra D/o. R Chandra Shakar	Bio-Chemistry	A Comprehensive Study on the Synthesis of Gum Karaya Biocomposite Silver Nanoparticles and its Biological Applications	Dr. Karuna Rupula Assoc. Professor, Dept. of Biochemistry, O.U., Hyd. (31/03/2017)
6	PHD44849	Mr. Zafir Ahamad S/o. Naazir Ahammed K	Geography	Morphological and Environmental Catastrophe, an Impact-Based Case Study of Barathapuzha River Degradation	Prof. T Anuradha Dept. of Geography, O.U., Hyd. (06/11/2017)

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Date : 10.06.2022

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Name of the Candidate: Ms. Rokkala Shyamala Chandra.

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Date of Joining: 06-04-2017.

Title of Ph.D: *"A Comprehensive Study on the Synthesis of Gum Karaya Biocomposite Silver Nanoparticles and its Biological Applications"*

Date: 10th June 2022.

Venue: Seminar Hall,

The research seminar was attended by faculty members, research scholars and the evaluation Committee consisting of:

1. Dr. Karuna Rupula, Head, Department of Biochemistry, University College of Science, OU.
2. Dr. Manjula Bhanoori, Chairperson, BOS in Biochemistry, University College of Science, OU.
3. Dr. Karuna Rupula, Research Supervisor, Associate Prof, Dept. of Biochemistry, UCS, OU..

Ms. Rokkala Shyamala Chandra Presented a First Seminar (Plan of Work) of the research work and several questions were raised and discussed by the Committee Members. Based on the satisfactory presentation of work and several suggestions made for improving the data, the above members recommend that the candidate be permitted to present Second Seminar to the Osmania University at Department of Biochemistry.

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Research Supervisor

Dr. Manjula Bhanoori
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Dr. Karuna Rupula
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Date : 10.07.2023

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Date: 10.07.2023 at 12.30 P M

Venue : Seminar Hall, Department of Biochemistry, University College of Science, Osmania University.


The research seminar was attended by faculty members, research scholars and the evaluation Committee consisting of:

1. Dr. Karuna Rupula, Chairperson, BOS in Biochemistry, Dept. of Biochemistry, UCS, OU, Hyd.
2. Prof. Manjula Bhanoori, Head, Department of Biochemistry, University College of Science, OU, Hyd.
3. Dr. Karuna Rupula, Research Supervisor, Dept. of Biochemistry, University College of Science, OU..


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Research Supervisor

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ANNEXURE – III

PROFORMA TO BE FILLED BY THE CANDIDATE SELECTED UNDER THE
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hereby agree that I would take leave for a minimum of one year for attending the
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employer that the required leave will be sanctioned for the purpose stated.

HYDERABAD

Date: 6/4/17

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Date:- 10.03.2017

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3	Zorapuri Anzana	F	BC-D	--	--	
4	P.Manoj Kumar	M	OC	PT	Prof. S. Satyanarayana Singh	OU
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HYDERABAD-500 007**

**A Comprehensive Study on the Synthesis of Gum Karaya
Biocomposite Silver Nanoparticles and its Biological
Applications**

THESIS SUBMITTED TO OSMANIA UNIVERSITY
in partial fulfilment of the requirements for the award of the degree of
DOCTOR OF PHILOSOPHY
IN
BIOCHEMISTRY

By

Rokkala Shyamala Chandra, M.Sc.

Under the Guidance of

Prof. Karuna Rupula

Department of Biochemistry, UCS
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DEPARTMENT OF BIOCHEMISTRY
UNIVERSITY COLLEGE OF SCIENCE
OSMANIA UNIVERSITY
Hyderabad – 500 007, Telangana, India

AUGUST – 2023

DECLARATION

I, hereby declare that the thesis entitled “**A Comprehensive Study on the Synthesis of Gum Karaya Biocomposite Silver Nanoparticles and its Biological Applications**” is original and has been carried out by me under the guidance of **Prof. Karuna Rupula**, at the Department of Biochemistry, UCS, Osmania University, Hyderabad for the Degree of “**Doctor of Philosophy**” in **Biochemistry**. The thesis has been checked for Plagiarism using TURNITIN software, having < **10%** similarity index. If anything is found guilty/copied from other sources I am the sole responsible for the same and I abide by any action taken by the University.

To the best of my knowledge and belief, it contains no material previously published or written by another person nor material, which has been accepted for the award of any other degree or diploma of a university or other institute of higher learning, except where due acknowledgment has been made in the text.

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Place: Hyderabad

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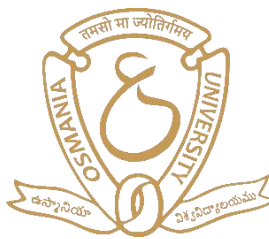
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CERTIFICATE

This is to certify that this thesis entitled “**A Comprehensive Study on the Synthesis of Gum Karaya Biocomposite Silver Nanoparticles and its Biological Applications**” submitted for the degree of Doctor of Philosophy in Biochemistry is a bonafide record of the research work carried out by **Ms. Rokkala Shyamala Chandra**, under my supervision and guidance at the Department of Biochemistry, University College of Science, Osmania University, Hyderabad. It is also further certified that the thesis is free from plagiarism after having checked using university-approved TURNITIN software. The similarity index (%) was found to be less than 10% and it is within the permissible limit. I hereby recommend the submission of this thesis for the degree of Doctor of Philosophy in Biochemistry.

Date:

Place: Hyderabad

Prof. Karuna Rupula

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*At the outset, I thank my guide and supervisor **Prof. Karuna Rupula**, Professor & Chairperson, Board of Studies, Department of Biochemistry, Osmania University, for giving me an opportunity to pursue and complete my research studies under her valuable guidance and constant encouragement.*

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Finally, nevertheless, I owe gratitude to many people, all of whom might not be acknowledged here, but I am in no doubt, that there will be opportunities outside the printed page to assure them of my deepest appreciation for their support.

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Rokkala Shyamala Chandra

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LIST OF ABBREVIATIONS

%	:	Percent
°C	:	Degree Celsius
$\mu\text{g mL}^{-1}$:	Microgram per milliliter
μg	:	Microgram
$\mu\text{g/mL}$:	Microgram per milliliter
μL	:	Microliter
$\mu\text{L mL}^{-1}$:	Microliter per milliliter
μm	:	Micrometer
μM	:	Micromolar
Å	:	Angstrom
AgNO_3	:	Silver nitrate
ATCC	:	American-type culture collection
CFU	:	Colony forming unit
cm	:	Centimeter
DCF	:	Dichlorofluorene
DLS	:	Dynamic light scattering
DMF	:	N, N-Dimethyl formamide
DMSO	:	Dimethyl sulfoxide
DNA	:	Deoxyribo nucleic acid
EDS	:	Energy dispersive spectroscopy
eV	:	Electron volts
fcc	:	Face centred cubic
FT-IR	:	Fourier transform infrared spectroscopy
FW	:	Fresh weight
g	:	gram
g/L	:	Gram per liter
GCC	:	Girijan Co-operative corporation
GRAS	:	Generally Recognized as Safe
h	:	Hour
H_2DCFDA	:	Dichlorodihydrofluorescein diacetate
H_2O_2	:	Hydrogen peroxide

HCl	:	Hydrochloric acid
HEPES	:	4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid
IC ₅₀	:	Inhibitory concentration 50
ICP-MS	:	Inductively coupled plasma mass spectroscopy
ICP-OES	:	Inductively coupled plasma- optical emission spectrometer
IR	:	Infrared
keV	:	kilo electron volts
KG	:	Karaya gum
Kg	:	Kilogram
KG-AgNPs	:	Gum karaya based silver nanoparticles
kPa	:	kilo Pascal
kV	:	kilo volts
L	:	Litre
LB	:	Lysogeny broth
M	:	Molar
m	:	Meter
mA	:	Milli ampere
MDA	:	Malondialdehyde
MDR	:	Multi-drug resistance
MHA	:	Mueller Hinton agar
MHB	:	Mueller-Hinton broth
MIC	:	Minimum inhibitory concentration
min	:	Minute
mL	:	Milli liter
mM	:	Milli molar
mm	:	Millimeter
mmole L ⁻¹	:	Milli mole per liter
MRSA	:	Methicillin-resistant <i>Staphylococcus aureus</i>
MTCC	:	Microbial type culture collection
mV	:	milli volts
NaCl	:	Sodium chloride
NaOH	:	Sodium hydroxide
nm	:	Nanometer

NPN	:	N-phenyl naphthylamine
NPs	:	Nanoparticles or Nanocomposite materials
NRRL	:	Northern Regional Research Laboratory
OD	:	Optical density
PALS	:	Phase analysis light scattering
PBS	:	Phosphate buffer saline
PDA	:	Potato dextrose agar
PDI	:	Poly dispersity index
ppb	:	Parts per billion
PPL	:	Priority Ptogens List
ppm	:	Parts per million
ppt	:	Parts per trillion
QUELS	:	Quase elastic light scattering
RNA	:	Ribonucleic acid
ROS	:	Reactive oxygen species
rpm	:	Revolutions per minute
s	:	Second
SD	:	Standard deviation
SEM	:	Scanning electron microscope
SEM-EDXA	:	Scanning electron microscopy – Energy dispersive X-ray analysis
SPR	:	Surface plasmon resonance
TEM	:	Transmission electron microscopy
UV	:	Ultra-violet
UV-vis	:	UV-visible spectroscopy
v/v	:	Volume/volume
VOC	:	Volatile organic compounds
w/v	:	Weight/volume
XRD	:	X-ray diffraction
YEPD	:	Yeast extract peptone dextrose
YES	:	Yeast extract sucrose
ZOI	:	Zone of inhibition
$\mu\text{mol g}^{-1}$:	Micro mole per gram



Chapter-1
General Introduction

1.1. INTRODUCTION

Nanotechnology is a novel scientific area that has the ability to create new and innovative materials. Nanotechnology deals with creating, assembling, measuring, and understanding nanoscale materials at sizes ranging between 1–100 nanometers (nm), with unique properties and novel applications. Nanomaterials have evolved as a fascinating class of substances that are in tremendous demand for a variety of commercial applications. The research and development involved in the design, synthesis, characterization, and use of devices and materials whose smallest functional organization is at least one dimension on the nanoscale scale or one billionth of a meter, is called nanotechnology (Silva GA 2004.)

The ability to convert nanoscience theory to useful applications that began in the early times of the 21st century has resulted in the development and progress of Nanotechnology and nanomaterials. The word ‘nano’ is derived from Greek prefix meaning ‘dwarf’ or something very small and depicts one thousand millionth of a meter (10^{-9} m). A nanometer is one-billionth of a meter and one-millionth of a millimeter, about four times the diameter of an atom. It has been very clearly stated by Professor Mauro Ferrari a nanoscientist that at the nanoscale level, there is no barrier between the various disciplines like chemistry, physics, engineering, mathematics, biology, etc.

It is difficult to trace the exact history of human use of nanosized materials. However, the history of nanomaterial utilization is from ancient times, and humans utilized nanoscale materials for numerous applications unintentionally for quite some time. The first evidence for nanoscience development can be traced to the 5th century B.C, by the Greeks and Democritus. Unknowingly, the early use of nanotechnology can be credited to the medieval artists who made stained glass articles between 500 and 1450 AD. Some of the well-known applications were the use of asbestos nanofibers to strengthen ceramic mixes around 4500 years ago (Florian et al., 2013) and lead sulfide (PbS) nanoparticles by the ancient Egyptians some 4000 years ago in an ancient hair colouring process (Walter et al., 2006; Jeevanandam et al., 2018).

The concept and the origin of nanotechnology were initially put forward in 1959 by renowned physicist Richard Feynman in his presentation “**There's Plenty of Room at the Bottom**”, in which he proposed the prospect of synthesis of nanoparticles by direct

manipulation of atoms. Norio Taniguchi a Japanese scientist coined the term "nanotechnology" in 1974, although it was not generally recognized at the time. The term "nanometer" was first proposed by Richard Zsigmondy, the 1925 Nobel Prize Laureate in chemistry. The concept and idea of nanotechnology were first introduced in public by Richard Feynman, an American physicist and Nobel Prize laureate in 1959. Based on the contributions of Feynman, Kim Eric Drexler published the book "**Engines of Creation: The Coming Era of Nanotechnology**" in 1986 and developed a concept of molecular nanotechnology. In this book, Drexler proposed the concept of using molecular structures at the nanoscale to serve as machines to guide and activate the synthesis of large molecules like robots that would form the basis of molecular manufacturing technology, enabling to literally build anything, atom by atom and molecule by molecule. Drexler also co-founded The Foresight Institute (with which he is no longer involved) in 1986 to assist and promote public awareness and comprehension of nanotechnology principles and consequences.

Although contemporary nanotechnology is relatively new, nanometer-scale materials have been extensively utilized for centuries. Early in the fourth century, artists from Rome observed that combining gold and silver with glass produced a striking result: the glass resembled slate green when lit from the outside but blazed red being lit from the inside. Gold and silver nanoparticles have been suspended in the glass solution, colouring it. The most renowned existing example of this method is the "**Lycurgus Cup**", a ceremonial cup. The dichroic effect phenomenon of exhibiting two different colours of the cup was explained and analyzed by scientists using Transmission electron microscopy (TEM) in 1990. Dichroism is observed due to the presence of Ag: Au alloy nanoparticles with a diameter of 50–100 nm. X-ray analysis showed the alloy ratio of Ag: Au at approximately 7:3 and also containing 10% copper (Cu) dispersed in a glass matrix. Au nanoparticles produce red colour due to absorption at ~520 nm and red-purple colour due to absorption of bigger particles while light scattering by Ag colloidal nanoparticles attributes green colour with size >40 nm. Most of the late medieval church windows also exhibit comparable effects of a gleaming dazzling red and yellow tint due to the integration of Au and Ag nanoparticles into a glass (Bayda et al., 2019).

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