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Dr. ARUN .S. PRASAD (MSc,Physics)

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University of Kerala

This is to certify that the project report entitled “ **ROOIBOS TEA MEDIATED SYNTHESIS AND STRUCTURAL ANALYSIS OF $Cu_{0.3}Zn_{0.7}SnO_3$ NANOPARTICLES** ” submitted by **AKHILA ANIL** in partial fulfillment of the requirements for the award of Master of Science in Physics at Sree Narayana College , Chengannur , is an authentic work carried out by her at Department of Physics , T.K.Madhava Memmorial College ,Alappuzha during the period from 4thJanuary 2021 to 15thJune 2021 under my supervision and guidance .The thesis has not formed the basis for the award of any other degree, diploma, associate ship , membership or similar title of any University or Institution.



Dr, ARUN .S. PRASAD

ABSTRACT

The biosynthesis of $\text{Cu}_{0.3}\text{Zn}_{0.7}\text{SnO}_3$ nanoparticles via *Aspalathus linearis* natural extract *Riboo*
tea is reported in this contribution. Crystallinity of Tetragonal perovskite $\text{Cu}_{0.3}\text{Zn}_{0.7}\text{SnO}_3$
nanoparticles at room temperature and annealed at 300 and 600⁰C was investigated by X ray
diffraction. High resolution transmission electron microscope (HRTEM) and high resolution
scanning electron microscope (HRSEM) were used for determination of morphology, confirmed
the nanoclusters of $\text{Cu}_{0.3}\text{Zn}_{0.7}\text{SnO}_3$ annealed at 500⁰C. Characterization of material was carried
out using XRD , UV-VISIBLE, FTIR tools. The uniform distributed single phase nanoparticles
were found using structure characterization tools for no impurity.

AMEENA MAJEED

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DEPARTMENT OF PHYSICS

Sree narayana college, kollam



Dr. Dedhila Devadathan

Research guide & assistant professor

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CERTIFICATE

This is to certify that Mrs Ameena Majeed ..Sree narayana college, chengannur, kerala university carried out her M. Sc project work on the topic "**structural and optical studies of cobalt aluminate nanoparticles** " under my guidance at department of physics, Sree narayana college, kollam

Dedhila
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ABSTRACT

Nanoscience is an interdisciplinary field that seeks to bring about mature nanotechnology, focusing on the nanoscale intersection of fields such as physics, engineering, chemistry, computer science, mechanics, materials science, electronics, biology, medicine and more. Chapter 1 is dealing with introduction to nanoscience as well as the aim of the present study.

In chapter 2 a brief description on the experimental technique used for the synthesis of metal oxide nanoparticles cobalt aluminate nanoparticles at different temperatures are discussed.

The chapter 3 describes all the structural and optical characterization techniques carried out for the nanoparticles. The structural characterizations of the synthesized samples were carried out using FTIR and XRD. The optical characterizations of the nanoparticles were done using UV-Vis spectroscopy.

The work is focussed on the effect of annealing on the characterizations of cobalt aluminate nanoparticles. But from XRD it can be concluded that the formed system is a nanocomposite or a heterostructure of cobalt oxide and cobalt aluminates. The optical characterizations done for nanoparticles at different temperatures showed the materials have multiple band gaps. Detailed structural and optical analysis of these samples are given in chapter 4. Importance have been given for the variations observed in formed samples with annealing temperature.

The project work is concluded with the summary and future scope of the work in chapter 5 followed by references.

ANGIRAS N NAMBOOTHIRI

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DEEMED TO BE UNIVERSITY UNDER SECTION 3 OF THE UGC ACT, 1956

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4th June 2021
Amritapuri

CERTIFICATE

This is to certify that **Angiras N Namboothiri**, fourth semester M.Sc (Physics) student of Sree Narayana College has successfully completed the project entitled "*Anthropic Principle and Large Number Hypothesis*" under the guidance of Dr. Narayanankutty Karuppath during the academic year 2019-2021, as requirement for the partial fulfillment for the completion of the course.

Dr. Narayanankutty Karuppath
Professor and Chair PGP
Department of Physics
Amrita School of Arts and

Sciences

Amritapuri, AVVP

ABSTRACT

In cosmology, the Anthropic Principle deals with the values of natural constants and the laws of nature. According to Anthropic Principle the constants of nature assume their values for the existence of life. This means that the constants are nature assuming their values not as a mere coincidence. Some evidence in nature shows that the ratios of some large numbers are of certain powers of ten. Anthropic principle is a philosophical explanation for the existence of life on earth. The value of age of the earth, the temperature of the earth, the position of the earth, the electromagnetic force between the elementary particles, etc. are not just a coincidence. They are the only values that can be possessed for the sustainability of life. Or else we have to say that life is adaptive.

The Large Number Hypothesis by Paul Dirac deals with the ratios of very large dimensionless numbers and it is found to be ten to the power of thirty nine. He also said that the similarity is these ratios are not a mere coincidence. Hence we can introduce the Anthropic Principle for providing a philosophical argument and mathematical proof for Dirac's hypothesis. His other assumption was that these large numbers vary with the age of the universe. This hypothesis was also revised by saying that these large number parameters are functions of deceleration parameters.



Post Graduate Department of Physics

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Dr. Vinoy Thomas

Assistant professor

Research Guide, Kerala University

CERTIFICATE

This is to Certify that **Mr. Anu Prakash Achari** M.Sc. Student from Sree Narayana College, Chengannur, Kerala University carried out his project work on the topic "**PLASMONIC INTERACTIONS IN NANOSYSTEMS**" Under my guidance at Department of Physics, Christian College, Chengannur.

VINOY THOMAS M.Sc., Ph.D.
Assistant Professor
Department of Physics
Christian College, Chengannur.

ABSTRACT

An investigation of surface plasmon resonance (SPR) of green synthesized silver nanoparticles is given in this thesis. The absorption of light by metal nanoparticles is dominated by the surface plasmon (SP) resonance. In small particles, the strong three-dimensional confinement changes both the static and dynamic optical properties. The surface plasmon resonance of silver nanoparticles was observed in the wavelength range 350-430nm. An effort has been made to study the Surface plasmon mediated excitation energy transfer (EET) between two spherical metal nanoparticles. Also we have made an attempt to calculate van der Waals (vdW) energy and Casimir energy between plasmonic silver nano particles in the present matrix as the energy of vacuum fluctuations of plasmonic modes existing in present system.

ARCHANA ARAVIND
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**Dr. Jojo P J
Associate Professor
Head Of the Department of Physics**

CERTIFICATE

This is certify that **Ms. ARCHANA ARAVIND** M.Sc student from Sree Narayana College, Chengannur, Kerala University carried out her M.Sc project work on topic "**Measurement Of Natural Gamma Radiation In Beach Sediment Of South west Part Of Kerala**" under my guidance at Department Of Physics, Fatima Mata National College, Kollam.

Dr P. J. JOJO
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PREFACE

Gamma radiation is a part of electromagnetic spectrum with high energy and very short wave length. The term gamma ray was coined by British physicist Ernest Rutherford in 1903 following early studies of radioactive nuclei. Application of gamma ray plays a crucial role in different filed of science including medicine. Medical applications of gamma rays include the informative imaging techniques of positron emission tomography (PET) and effective radiation therapies to treat cancerous tumours. In PET scan, a short lived positron- emitting radioactive pharmaceutical is chosen because of its participation in a particular physiological process (E.g; brain function). The radioactive material usually called dye is injected in to the body. Emitted positrons quickly combine with nearby electrons and, through pair annihilation, gives rise to two 511 KeV gamma rays travelling in opposite directions. After detection of the gamma rays, a computer-generated reconstruction of the locations of the Gamma-Ray emissions produces an image that highlights the location of the biological process being examined. Gamma rays present in the environment has major origin from the terrestrial primordial radionuclides. Human beings are continuously exposed to these radiations all through their life span. Measurement of gamma radiation exposure and the radiation dose imparted by them to human beings are always a matter of concern. The measurement of ambient gamma levels in the south west part of Kerala has been carried out along with a theoretical comparison with the estimated gamma dose resulting from the primordial radionuclides namely radium, thorium and potassium present in the soil of the region.



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This is to Certify that **Mr. Harkishal S** M.Sc. Student from Sree Narayana College, Chengannur, Kerala University carried out his project work on the topic "**SYNTHESIS OF ANISOTROPIC NANO MATERIALS AND EVALUATION OF BAND GAPS**" Under my guidance at Department of Physics, Christian College, Chengannur.

Dr. Vinoy Thomas
Assistant Professor
Department of Physics
Christian College, Chengannur

ABSTRACT

Bio inspired synthesis of metal nanoparticles is evolving into an important branch of nanotechnology. Anisotropic nanoparticles are ideal building blocks for a number of functional materials due to their exceptional and anisotropic optical, electronic, magnetic and mechanical properties. This thesis presents the biosynthesis of silver nanoparticles using hydrogen peroxide as reducing and citrate as stabilizing agent. The synthesized nanoparticles are characterized using UV-Visible, and optical band gap. In the present case, H₂O₂ acts as an oxidant from the very beginning of the reaction. We also found that particle morphology strongly affects the SPR peaks. The band gap of each plasmonic system was evaluated and tabulated.

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Dr. Vinoy Thomas

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This is to Certify that **Ms. Lekshmi U.** M.Sc. Student from Sree Narayana College, Chengannur, Kerala University carried out her project work on the topic "**COLORIMETRIC SENSING OF HYDROGEN PEROXIDE USING SILVER NANOPARTICLES**" Under my guidance at Department of Physics, Christian College, Chengannur.

VINOY THOMAS M.Sc., Ph.D
Assistant Professor
Department of Physics
Christian College, Chengannur.

ABSTRACT

Nanomaterials are particles whose dimension lies within the range of 1 nm to 100 nm. In the nanoscale level, many properties get modified when compared to molecular level. Silver nanoparticles have unique optical, electrical and thermal properties ranging from photovoltaics to biological and chemical sensors.

Hydrogen peroxide is a reactive oxygen species present in the human body which controls a lot of biological processes.

In this work silver nanoparticles were synthesised by chemical reduction using tri sodium citrate. The solution will be of golden yellow colour after about 15 minutes of preparation, indicating the formation of silver nanoparticles. These citrate stabilized silver nanoparticles are synthesized and characterized by UV-Vis Spectroscopy, TEM, FTIR methods. Using these, a spectroscopy method has been developed for determination of hydrogen peroxide. The rapid colour change of the solution from milky white to colourless indicate that the solution can act as colorimetric sensor. Therefore, the colorimetric hydrogen peroxide sensor has great applications in bio medical research as sensors.

MRIDU R MURALI
REG.NO.63019128009



Dr Mahesh S K
Assistant Professor
P G Dept. of Physics
NSS College, Pandalam

CERTIFICATE

This is to certify that this project report entitled "**EFFECT OF ALUMINUM SUBSTITUTION ON THE OPTICAL PROPERTIES OF PRASEODYMIUM MOLYBDATE YELLOW PIGMENTS**" submitted to University of Kerala in partial fulfilment of the requirement for the award of the **DEGREE OF MASTER SCIENCE IN PHYSICS** is a bonafide record of the project work done by **MRIDU R MURALI** during the period February 2021 to July 2021, under my guidance at NSS College, Pandalam.

A handwritten signature in black ink, appearing to be 'MSK', is written above the name of the signatory.

Dr Mahesh S K



Sree Narayana College Chengannur

(Affiliated to University of Kerala & NAAC Accredited by Grade B)

Department of Physics

Dr. K. Sreelatha

Assistant professor & Head

15/7/2021

CERTIFICATE

This is to certify that the dissertation entitled "**EFFECT OF ALUMINIUM SUBSTITUTION ON THE OPTICAL PROPERTIES OF PRASEODYMIUM MOLYBDATE YELLOW PIGMENTS**" is an authentic record of Project work carried out by **Miss. Mridu R Murali** in partial fulfilment of the requirements for the award of Master of Science in Physics.

Dr. K. Sreelatha

Head of the Department of Physics
Sree Narayana College, Chengannur

NANDU MOHAN
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CERTIFICATE

This is to certify that the dissertation entitled “**SYNTHESIS AND CHARACTERIZATION OF COPPER DOPED MELAMINIUM PHTHALATE SINGLE CRYSTALS**” submitted to the **University of Kerala** in partial fulfilment of the requirement for the award of the degree of **MASTER OF SCIENCE IN PHYSICS** is a record of original research work done by **NANDU MOHAN** during the period 2020-2021, under my guidance at St. Gregorios College, Kottarakkara.

Dr. Indulal. C R

ABSTRACT

Solids are one of the four fundamental states of matter. In solids, the particles are arranged in a definite manner so that they have a regular shape. Solids are mainly classified as crystalline solids and amorphous solids. Many studies are developing in the field of solids. In this project we are discussing about crystalline solids. Crystalline solids have use in many areas of developments. The word 'crystal' comes from a Greek word which means clear ice. Crystals are used in many fields of day-to-day life such as industrial, medicine, agriculture, research, household, etc. In the area of medicine, a primitive type of healing is done with the help of many crystals such as quartz, agate, amethyst or opals.

In this project we prepared single crystals of copper doped melaminium phthalate. Single crystals of copper doped melaminium phthalate were grown from aqueous solution by slow solvent evaporation method at room temperature. X-ray powder diffraction analysis confirmed that the copper doped melaminium phthalate crystallizes in orthorhombic system. UV spectroscopy studies of copper doped melaminium phthalate crystal were done. The direct optical bandgap value of copper doped melaminium phthalate powder crystal was found to be 2.64eV.

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Sree narayana college,kollam



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CERTIFICATE

This is to certify that Ms.NEETHU S;Sree narayana college, chengannur,kerala university carried out her M.Sc project work on the topic "**Structural and optical studies of Copper Aluminate nanoparticles**" under my guidance of department of physics,Sree narayana college,Kollam.

Dedhila
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Assistant Professor, Department of Physics
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ABSTRACT

Nanoscience is a developing research area which has seen a burst of scientific and industrial interest over the last few years. The chapter 1 deals with an introduction to nanomaterials. In addition, the chapter discusses the aim of the present work.

In chapter 2 a brief description on the experimental technique used for the synthesis of metal oxide nanoparticles copper aluminate nanoparticles at different temperatures (500°C and 700°C) are discussed.

The chapter 3 describes all the structural and optical characterization techniques carried out for the nanoparticles. The structural characterizations of the synthesized samples were carried out using FTIR and XRD. The optical characterizations of the nanoparticles were done using UV-Vis spectroscopy.

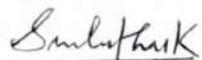
The work is focussed on the effect of annealing on the characterizations of copper aluminate nanoparticles. But from XRD it can be concluded that the formed system is a nanocomposite or a heterostructure of copper oxide and copper aluminates. The results obtained for the structural confirmed the formation of $\text{CuAl}_2\text{O}_4/\text{CuO}$ nanoparticles. The optical characterizations done for $\text{CuAl}_2\text{O}_4/\text{CuO}$ nanoparticles at different temperatures showed the materials have multiple band gaps. Detailed structural and optical analysis of these samples are given in chapter 4.

In the present world there is a pressing demand to develop new antimicrobial agents and discover novel strategies due to the emerging infectious diseases. The chapter 5 presents the antibacterial studies of synthesized nanoparticles. The present study investigates the antimicrobial activity of the synthesized samples. The gram positive bacteria: *Bacillus cereus*, the gram negative bacteria: *Escherichia Coli* are the microbes used in the present study. The project work is concluded with the summary and future scope of the work in chapter 6 followed by references.

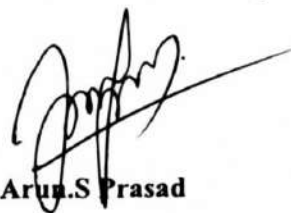
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CERTIFICATE

This is to certify that this project report entitled "SYNTHESIS , CHARACTERISATION AND OPTICAL STUDIES OF ZnSnO₃ NANOPARTICLES USING ROOIBOS TEA NATURAL EXTRACTS" is a bona-fide record of the work done by **PRIYANKA P** under my guidance and supervision in partial fulfillment of the requirement for the award of the Degree of Master of Science in Physics, from Kerala University. It is further certified that no part of this work has been presented for the award of any other Degree or Diploma by any other university or Institution.



Dr. SREELATHA K
Head of the Department



Dr. Arun.S Prasad
Assistant Professor
Supervising Guide

Examiners

- 1.
- 2.

Chengannur

Date:

ABSTRACT

The biosynthesis of ZnSnO₃ nanoparticle via *Aspalathus Linearis* natural extract is reported in this contribution . *Aspalathus Linearis* is a broom like member of the fabaceae family of plants commonly known as rooibos , grows naturally in the cederberg area the western cape province of South Africa and is known for its commercial use as herbal tea . In the present research work we have extracted *Aspalathus Linearis* from green tea through several steps which fall into several categories : material treatments , extraction of tea , isolation and finally drying of tea leaves .

Crystallinity of perovskite ZnSnO₃ nanoparticles at room temperature and was investigated by X-ray diffraction . Characterization of the material was carried out using XRD,UV,FTIR, tools also. The uniform distributed single phase nanoparticles were found using structures characterization tools for no impurities . Nanoparticles are recently utilized in electrochemical purpose of alcohols, gases ,acetone, H₂O₂, and neurotransmitters exhibiting good selectivity ,sensitivity, ,excellent reproducibility, and anti-interference ability . Moreover they have been utilized as catalyst in oxygen reduction and hydrogen evolution reaction.

CERTIFICATE

This is to certify that the project "BAND STRUCTURE AND DENSITY OF STATES STUDIES OF GRAPHENE AND GRAPHITE USING DENSITY FUNCTIONAL THEORY" is done by Sarangi Krishna K under my guidance towards the partial fulfilment for the award of Master of Science Degree in Physics from the University of Kerala for the academic year 2019-2021.



ARYA B

Assistant Professor

University college, TVPM

ABSTRACT

In order to find and study about materials with suitable electrical properties, a wide range of theoretical and experimental methods are used. The most commonly used method for theoretical calculations is density functional theory (DFT). It is a method where the electronic structure is described as a functional of the electronic density. There are a number of different numerical implementations of DFT using different approximations. In this project, DFT using plane waves and approximations is used. This project has been carried out using the Quantum Espresso software with pseudopotentials. Using Quantum Espresso, band structures and density of states of two types of materials are calculated; graphene as a 2D system and graphite as a 3D system. It reflects the fact that the graphite allotrope of carbon consists of stacked graphene layers. The band structures obtained are then compared to experimental results to see if the pseudopotentials manage to accurately describe the characteristics of the real band structures.

In the first two chapters of this report, a background to the theory used in this thesis is described, giving a more detailed explanation of basic solid state physics and density functional theory. Chapter one includes discussion on crystal lattices, reciprocal lattice, Bloch's theorem, Fermi energy, Band structure, Spin Orbit Coupling and density of states. The correlated many body problem, Density Functional theory, the Kohn-Sham theorems, the Kohn-Sham potential, the exchange correlation functional, plane wave basis set and pseudopotential methods are discussed in chapter 2. In the third chapter, the methods used for the calculations are explained. Calculations carried out for the sample systems are also included in this chapter. Lastly, the results from the band structure and density of states calculations are presented and discussed.

The conclusion, limitations and scope of the work are included in the last section.

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This is to certify that Ms.SHEKHA.G;Sree Narayana college, chengannur,kerala university carried out her M.Sc project work on the topic "**STUDIES ON SPECIFIC ABSORPTION RATE OF CELLULAR TOWERS RADIATION**" under my guidance of department of physics, FATIMA MATA NATIONAL COLLEGE ,Kollam.

Dr Jojo P.J.
Principal
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PREFACE

As part of the M.Sc. curriculum, I have undertaken a project work entitled `Studies on specific absorption rate of cellular towers radiation'. This project consists of a general introduction which highlights about radiation - sources, types and its health effects .It is followed by Review of Literature regarding my topic of study. The instrumentation and methodology are elaborately pointed out in the chapter that follows. The experimental details used for the study is provided and the result analysis and conclusions are made based on the study.

SIVAKUMAR S
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CERTIFICATE

This is to certify that the dissertation entitled “**LANTHANUM STRONTIUM OXIDE NANOCOMPOSITE FOR FUTURE TECHNOLOGICAL APPLICATIONS**” submitted to the **University of Kerala** in partial fulfilment of the requirement for the award of the degree of **MASTER OF SCIENCE IN PHYSICS** is a record of original research work done by **SIVAKUMAR S** during the period 2020-2021, under my guidance at St. Gregorios College, Kottarakkara.

Dr. Indulal. C R

ABSTRACT

Nanomaterials are not only a hotbed of discovery but also a burgeoning economic field with a wide range of applications. Nanomaterials are fascinating because they exhibit peculiar optical, magnetic, electrical, and other properties at such a small scale. These emergent properties may have huge implications in electronics, medicine, and other fields. Nanomaterials have a long and illustrious past. Nanomaterials have been around since the big bang when nanostructures were first produced in the first meteorites. The story of nanomaterials in science, on the other hand, begins much later. Michael Faraday synthesized colloidal gold particles in 1857, which was one of the first scientific findings. For over 70 years, nanostructured catalysis has been studied. Nanoparticle synthesis is one of the complex processes. There are several methods for creating nanoparticles, including gas condensation, attrition, chemical precipitation, ion implantation, pyrolysis, and hydrothermal synthesis. Characterization is necessary to establish understanding and control of nanoparticle synthesis and applications. Characterization has been carried out using different techniques; mainly drawn from material science. In the present work, samples are characterized through X-ray diffraction spectroscopy and Ultraviolet-Visible spectroscopy. The optical bandgap of the sample is calculated through the Tauc's relation by the analysis of the UV graph.

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CERTIFICATE

This is to certify that this project report entitled “**EFFECT OF NICKEL SUSTITUTION ON THE ABSORPTION CHARACTERISTICS OF MANGANESE TUNGSTATE SYNTHESISED VIA CITRATE-GEL METHOD**” submitted to University of Kerala in partial fulfilment of the requirement for the award of the **DEGREE OF MASTER SCIENCE IN PHYSICS** is a bonafide record of the project work done by **SREELEKSHMI A** during the period February 2021 to July 2021, under my guidance at NSS College, Pandalam.

Dr Mahesh S K



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15/7/2021

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This is to certify that the dissertation entitled "**EFFECT OF NICKEL SUBSTITUTION ON THE ABSORPTION CHARACTERISTICS OF MANGANESE TUNGSTATE SYNTHESIZED VIA CITRATE-GEL METHOD**" is an authentic record of Project work carried out by **Miss. Sreelekshmi A** in partial fulfilment of the requirements for the award of Master of Science in Physics.

Dr. K. Sreelatha

Head of the Department of Physics

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CERTIFICATE

This is to certify that the dissertation entitled “**STRUCTURAL AND DIRECT OPTICAL BANDGAP STUDIES OF LANTHANUM BARIUM OXIDE NANOCOMPOSITE SYNTHESIZED VIA CO-PRECIPITATION ROUTE**” submitted to the **University of Kerala** in partial fulfilment of the requirement for the award of the degree of **MASTER OF SCIENCE IN PHYSICS** is a record of original research work done by **SUBIN BALACHANDRAN** during the period 2020-2021, under my guidance at St. Gregorios College, Kottarakkara.

Dr. Indulal. C R

PREFACE

A nanoparticle, also known as an ultrafine particle, is a small particle of matter with a diameter of 1 to 100 nanometres (nm). The use of the terms nanoparticles and ultrafine particles interchangeably dates back to the 1970s. When the first comprehensive fundamental studies of "nanoparticles" were carried out in the United States (by Granqvist and Buhrman) and Japan (as part of an ERATO Project), they were dubbed "ultrafine particles" (UFP).

One of the most difficult processes is nanoparticle synthesis. The vapour phase, solution precipitation and solid-state processes are the three main categories of nanoparticle synthesis. Characterization was carried out using a variety of methods, the majority of which were derived from material science. X-ray diffraction spectroscopy (XRD) and ultraviolet (UV) visible spectroscopy are used to classify samples in this study. The optical band gap of the sample is determined using Tauc's relation and UV graph analysis.

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This is to Certify that **Mr. Suraj S Nair** M.Sc. Student from Sree Narayana College, Chengannur, Kerala University carried out his project work on the topic "**RAPID SYNTHESIS OF SILVER NANO PARTICLES FOR FLUORESCENT QUENCHING**" Under my guidance at Department of Physics, Christian College, Chengannur.

VINOY THOMAS M.Sc., Ph.D
Assistant Professor
Department of Physics
Christian College, Chengannur.

ABSTRACT

In recent years Nano Science and Technology has received tremendous attention in research Fields. The development of new economically feasible methods for the production of metal nano particles have introduced pilot scale production of metal nano particles, that have gained market in various consumer products. The most important feature of nano particles are their surface area to volume ratio, where it easily allows them to interact with other particles. The main advantage of metal nano particles is that, they enhance Rayleigh and Raman scattering.

The silver nano particles are one of the most attractive inorganic materials because of it's environment free nature. Moreover, it has several applications in various fields like, photography, diagnostics, catalysis, biosensor, anti-microbial etc.

This Project aims the synthesis and characterization of silver nano particles. Here we employ the green synthesis, the eco-Friendly method for its extraction from green tea leaves. Hence, by UV spectroscopy and fluorescence spectroscopy, we characterize the nature and features of silver nano particles. From that we find it's optical properties for fluorescent quenching. This finding has a remarkable importance in the field of Nano-technology.



PG DEPARTMENT OF PHYSICS

NSS COLLEGE PANDALAM

PATHANAMTHITTA

CERTIFICATE

This is certify that **Mr.VIJESH VIJAYAN** M.Sc student from Sree Narayana College, Chengannur, Kerala University carried out his M.Sc project work on topic '**Synthesis and characterization of cerium oxide nanoparticles and copper doped cerium oxide nanoparticles**' under my guidance at Department Of Physics, N S S College, Pandalam.



ABSTRACT

Nanoparticles of rare earth oxides, in particular, cerium oxide, has been extensively studied due to its commercial applications as a catalyst, oxygen sensor, solid electrolyte, and absorbent, among others. It is well known that rare earth oxides were used as catalysts in a wide variety of reactions of industrial and environmental interest. These oxides has a high oxygen mobility and storage capacity, and can act as a local source or sink for oxygen involved in reactions taking place on its surface. In the present work, nanoparticles of ceria were synthesized using chemical precipitation technique using Cerium (III) nitrate hexa hydrate and Sodium hydroxide as precussers. The nanoparticles of Cerium oxide were also synthesized using tri Ethanol Ammine (TEA) as the surfactant. The XRD pattern of nanoparticles of ceria were recorded. From the XRD pattern it was observed that ceria nanoparticles of present study are in cubic phase. The grain size of the particles calculated from XRD pattern is about 10nm. The band gap of nanoparticles of ceria calculated from UV- visible spectrum absorption is about 4.95eV. It is found that there is an increase in band gap as compared with bulk material. The photoluminescence spectra was also recorded. The emission peak was observed at 404nm and is less compared to the band gap of ceria. The emission peak can be attributed to radiative transitions between defects levels due to oxygen vacancies.

Nanoparticles of copper doped cerium oxide was also prepared by chemical precipitation method. XRD, UV Visible analysis was also done. It was observed that the band gap decreased with increase in concentration of Cu.