Details of collaborative activities for research, faculty exchange, student exchange, internship, on-the-job training, project work, etc. during the year 2022-23

Department of Chemistry

Appendix-II

PROJECT COMPLETION CERTIFICATE
(FOR ASPIRE SCHOLARSHIP - 2022-23)

This is to certify that Sri/Smt..... AGNA EDISON..... PG.....student of..... MAHARAJAS COLLEGE, ERNAKULAM.....affiliated to.....St. Teresa s College, Kochi.....has sucessfully completed his/her Aspire Scholarship Project/Internship entitled .....microwave assisted on-pot Synthesis of biologically active Cellulose based Schiff base Zn(II) complex. within the stipulated month(s) from.....March 23rd..... to.....April 23rd..... under the guidance of Prof/Dr.....Dr. Saritha Chandran A..... of our(St. Teresa s College, Kochi) institution

Signature

Name & Designation

(Head of the Host Institution)

DR SARITHA CHANDRAN A
ASSISTANT PROFESSOR
DEPARTMENT OF CHEMISTRY
TERESA'S COLLEGE
ERNAKULAM 682011

Name & Designation

(Guide of Host Institution)

ST. TERESA'S COLLEGE AUTONOMOUS

(Office Seal)

(Principal/HOD/Institution)

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL IN CHARGE
ST. TERESA'S COLLEGE
Autonomous
ERNAKULAM

Encl:1) Project Report

2)Attendance certificate from parent institution(as per notification dated.....)

ST. TERESA'S COLLEGE(AUTONOMOUS), ERNAKULAM

DEPARTMENT OF CHEMISTRY

CERTIFICATE

This is to certify that Ms Agna Edison (Admission number 8617) is a second-yearM.Sc.Applied Chemistry student at Maharajas College,Ernakulam.She completed her research work under the ASPIRE fellowship scheme at the Department of Chemistry, St. Teresa'sCollege (Autonomous), Ernakulam from March 23rd to April 23rd 2023.Her attendance atSt. Teresa's College during this period is above 90%.

Date: 05/05/23

Guide

DR SARITHA CHANDRAN A
ASSISTANT PROFESSOR
DEPARTMENT OF CHEMISTRY
ST TERESA'S COLLEGE
ERNAKULAM - 82011

PRINCIPAL

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL
ST. TERE[illegible]

ST. TERESA'S COLLEGE AUTONOMOUS
ERNAKULAM-682 011

Appendix-II

PROJECT COMPLETION CERTIFICATE
(FOR ASPIRE SCHOLARSHIP - 2022-23)

This is to certify that Sri/Smt..... ARYA RAJEEV..... PG.....student of..... MAHARAJAS COLLEGE, ERNAKULAM.....affiliated to.....St. Teresa s College, Kochi.....has sucessfully completed his/her Aspire Scholarship Project/Internship entitled Room temperature synthesis of MOFs and its characterisation, surface area analysis and thermal stability analysis within the stipulated month(s) from March 23rd to April 22nd under the guidance of Prof/Dr. Saritha Chandran A of our(St. Teresa s College, Kochi) institution

Signature

Name & Designation

(Head of the Host Institution)

DR SARITHA CHANDRAN A
ASSISTANT PROFESSOR
DEPARTMENT OF CHEMISTRY
ST. TERESA'S COLLEGE
ERNAKULAM - 682011

05/05/23

Name & Designation

(Guide of Host Institution)

(Office Seal)

ST. TERESA'S COLLEGE AUTONOMOUS
ERNAKULAM-682 011

(Principal/HOD/Institution)

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL IN CHARGE
ST. TERESA'S COLLEGE
Autonomous
ERNAKULAM

Encl:1) Project Report

2)Attendance certificate from parent institution(as per notification dated.....)

ST. TERASA'S COLLEGE (AUTONOMOUS), ERNAKULAM

DEPARTMENT OF CHEMISTRY

Certificate

This is to certify Ms ARYA RAJEEV (Admission number-7871) is a second year MSc Chemistry student of Maharajas College, Ernakulam. She performed her research work under the ASPIRE Fellowship scheme at the Department of Chemistry, St Teresa's College (Autonomous), Ernakulam from March 23rd to April 23rd. Her attendance at St. Terasa's college during this period is above 90%.

Date: 05/05/23

Guide

PRINCIPAL

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL IN CHARGE
ST. TERESA'S COLLEGE
Autonomous
ERNAKULAM

DR SABITHA CHANDRAN A
ASSISTANT PROFESSOR
DEPARTMENT OF CHEMISTRY
ST TERESA'S COLLEGE
ERNAKULAM - 682011

Joining Report

Ref: S1/1099/2023/DCE..... Dated: 18-03-2023.

As per the reference sited above LAKSHMI ANILKUMAR (CHAKKANALY H, SREEMOOLANAGARAM P O, SREEMOOLANAGARAM, ALUVA, 683580, ERNAKULAM, Kerala) has joined St. Teresa's College, Ernakulam with effect from ...23-03-2023/... in the ...Afternoon..... for doing the internship for Aspire Scholarship.

Date: 23-03-2023

Project Guide Elizabeth

Dr. Assistant Professor
Dept. of Chemistry
St. Teresa's College (Autonomous)
Ernakulam

Principal

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL IN CHARGE
ST. TERESA'S COLLEGE
Autonomous
ERNAKULAM

ST. TERESA'S COLLEGE AUTONOMOUS
ERNAKULAM-682 011

Joining Report

Ref: St/109/2023/DCE Dated: 15-03-2023

As per the reference sited above Mufeeda M P (Meppalli poyil H.O, Nittor P.O,673507,Kozhikode, Kerala) has joined in the ST. Teresa's College Ernakulam with effect from 23-03-2023 in the Chemistry for doing the internship for Aspire Scholarship.

Date: 23-03-2023

Project Guide

Elizabeth

Dr. Elizabeth Cyrille
Assistant Professor
Dept. of Chemistry
St. Teresa's College (Autonomous)
Ernakulam

Principal

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL IN CHARGE
ST. TERESA'S COLLEGE
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ERNAKULAM-682 011

Appendix-II

PROJECT COMPLETION CERTIFICATE
(FOR ASPIRE SCHOLARSHIP - 2022-23)

This is to certify that ~~Sri~~/Smt..... MUFEEDA . M. P..... PG.....student of..... MAHARAJAS COLLEGE, ERNAKULAM.....affiliated to.....St. Teresa,s College, Kochi.....has sucessfully completed his/her Aspire Scholarship Project/Internship entitled Facile synthesis of MoS2@mesocarbon nitride composite and their thermal stability and surface area analysis within the stipulated month(s) from March 23rd to April 23rd under the guidance of Prof/Dr. Elizabeth Kuruvilla.....of our(St. Teresa s College, Kochi) institution

Signature

Name & Designation

(Head of the Host Institution)

Elizabeth

Name & Designation

(Guide of Host Institution)

Dr. Elizabeth Kuruvilla
Assistant Professor
Dept of Chemistry
St Teresa's College

ST. TERESA'S COLLEGE AUTONOMOUS
(Office Seal)

(Principal/HOD/Institution)

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL IN CHARGE
ST. TERESA'S COLLEGE
Autonomous
ERNAKULAM

Encl:1) Project Report

2)Attendance certificate from parent institution(as per notification dated.....)

ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

DEPARTMENT OF CHEMISTRY

CERTIFICATE

This is to certify that Ms Mufeeda M P (Admission number 9121) is a second-year M.Sc. Applied Chemistry student at Maharaja's College, Ernakulam. She completed her research work under the ASPIRE fellowship scheme at the Department of Chemistry, St. Teresa's College (Autonomous), Ernakulam from March 23rd to April 23rd 2023. Her attendance at St. Teresa's College during this period is above 90%.

Date:

PRINCIPAL

ST. TERESA'S COLLEGE AUTONOMOUS

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL IN CHARGE
ST. TERESA'S COLLEGE
Autonomous
ERNAKULAM

Elizabeth

Dr. Elizabeth Kunnilla

Appendix-II

PROJECT COMPLETION CERTIFICATE
(FOR ASPIRE SCHOLARSHIP - 2022-23)

This is to certify that Sri/Smt..... NAYANA K K..... PG.....student of..... MAHARAJAS COLLEGE, ERNAKULAM.....affiliated to.....St. Teresa s College, Kochi.....has sucessfully completed his/her Aspire Scholarship Project/Internship entitled Synthesis and structure investigation of 2-Pyrazoline derivatives within the stipulated month(s) from March 23rd to April 23rd under the guidance of Prof/Dr. Elizabeth Kuruvilla.....of our(St. Teresa s College, Kochi) institution

Signature
Name & Designation
(Head of the Host Institution)

Elizabeth
Name & Designation
(Guide of Host Institution)
Dr. Elizabeth Kuruvilla
Assistant Professor
Dept of Chemistry
St. Teresa's College

(Office Seal)

(Principal/HOD/Institution)

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL IN CHARGE
ST. TERESA'S COLLEGE
Autonomous
ERNAKULAM

Encl:1) Project Report
2)Attendance certificate from parent institution(as per notification dated.....)

ST. TERESA'S COLLEGE AUTONOMOUS * ERNAKULAM-682 011 *

ST. TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

DEPARTMENT OF CHEMISTRY

CERTIFICATE

This is to certify that Ms Nayana K K (Admission number 9067) is a second-year M.Sc. Analytical Chemistry student at Maharajas College, Ernakulam. She completed her research work under the ASPIRE fellowship scheme at the Department of Chemistry, St. Teresa's College (Autonomous), Ernakulam from March 23rd to April 23rd 2023. Her attendance at St. Teresa's College during this period is above 90%.

Date: 6/5/23

PRINCIPAL

Dr. ALPHONSA VIJAYA JOSEPH
PRINCIPAL IN CHARGE
ST. TERESA'S COLLEGE
Autonomous
ERNAKULAM

ST. TERESA'S COLLEGE AUTONOMOUS
ERNAKULAM-682 011

Dr. Elizabeth Cornille
Assistant Professor
Department of Chemistry STC

PROFORMA FOR THE SUBMISSION OF COMPLETED PROJECTS

1. **Title of the project:**
   Microwave assisted Green Synthesis of Iron Oxide Nanoparticles Using Clammy Cherry (*Cordia obliqua Willd*): A Multifunctional Nanomaterial for Antibacterial, Catalytic, Antioxidant, and Photocatalytic Applications

2. **Name:** Sreelakshmi Dileep
3. **Identification number:** 020430273516
4. **Affiliation:**

a. Parent Institution	b. Host Institution
Maharajas College, Ernakulam	St Teresa's College, Ernakulam

5. **Abstract:**

Metal oxide nanoparticles are an important class of nanoparticles because of their extensive application in medicine, material science, electronics and environmental remediation. Green synthesis of nanoparticles, that does not use any toxic chemicals for the synthesis, is emerging as an important branch of nanotechnology. In this study, microwave assisted green synthesis of exceptionally stable Iron oxide NPs were synthesised using *Cordia obliqua Willd* fruit extract as a reducing agent and iron salts as precursors. The prepared IONPs were characterised using FTIR, XRD and SEM-EDAX analysis. The SEM analysis revealed distorted cube-like morphology of the nanoparticles can that enhance their surface area, making them more accessible to reactants and increasing their catalytic activity. The role of the IONPs as an antibacterial agent against E coli was studied and was found to be effective. The catalytic, antioxidant and photocatalytic applications was also evaluated and was found to be appealing for environmental pollution remediation applications.

6. **Introduction:**

Nanotechnology refers to those branches of science and engineering where materials, structures, devices, and systems are designed, characterized, produced, and used in accordance with processes occurring at dimensions in the nano meter range. It is possible to observe and manipulate individual atoms and molecules through nanoscience and nanotechnology. Thus, all other scientific disciplines, including chemistry, biology, physics, materials science, and engineering, can benefit from nanoscience and nanotechnology. Metal oxide nanoparticles are one of the most important nanoparticles and plays an important role in many areas like chemistry, material science, physics, etc. Due to their small dimension and abundant corner or edge surface sites, metal oxide nanoparticles can display unusual physical and chemical characteristics. Iron oxide (IO) is a ubiquitous compound occurring naturally and can also be synthesized in the laboratory. There are about 16 known iron oxides, which are created chemically when iron and oxygen combine. Rust is a type of iron (III) oxide that can be found in nature. Iron oxides are typically common, extensively used because they are cheap, and essential in many geological and biological processes. Humans also use them widely for things like haemoglobin, coatings, paints, and durable pigments (used in coloured concrete and thermite). Magnetite (Fe_3O_4), maghemite (Fe_2O_3), and hematite (Fe_2O_3) are the three types of iron oxides that occur most frequently in nature. Iron Fe_3O_4-NPs has drawn a lot of interest among the various types of iron oxide nanoparticles, including FeO (OH), Fe_2O_3, Fe_2O_3, and Fe_2O_3, due to its notable qualities, including magnetic property, biocompatibility, and high surface to volume ratio.

Due to their superparamagnetic qualities and possibility for biological uses brought on by their biocompatibility and lack of toxicity, IO nanoparticles have garnered a great deal of attention.

IONPs can be synthesized using various methods, including chemical, physical, and biological methods. Each method has its advantages and limitations, and the choice of method depends on the specific application and requirements. However, green synthesis methods such as biological methods have gained significant attention due to their eco-friendly and cost-effective nature.

7. Methodology:

MATERIALS AND METHODS

Materials required

All chemicals that includes Ferrous ammonium sulphate [$(NH_4)_2Fe(SO_4)_2(H_2O)_6$], Ferric chloride [$FeCl_3$], Sodium hydroxide[NaOH], Hydrogen peroxide[H_2O_2], Sodium borohydride[$NaBH_4$], Methylene blue, Congo red, DPPH were obtained from Nice Chemicals, India.

Microwave oven (wave (LG) Model 1S2021CW at 2450 MHz) was used for the IONPs synthesis.

Preparation of Clammy cherry extract

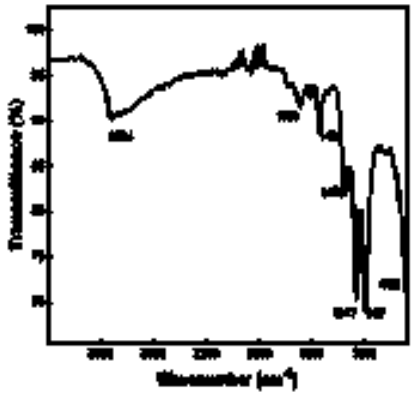
Ripened Clammy cherry fruits were collected from Maharajas college campus, Kerala, India. 10 g of Clammy cherries were thoroughly washed with deionized water several times, and then these fruits were refluxed with 100 ml of deionized water under microwave heating for 2 minutes at 420 W. The aqueous extract was cooled and filtered with Whatmann 40 filter paper and filtrate was used for synthesis.

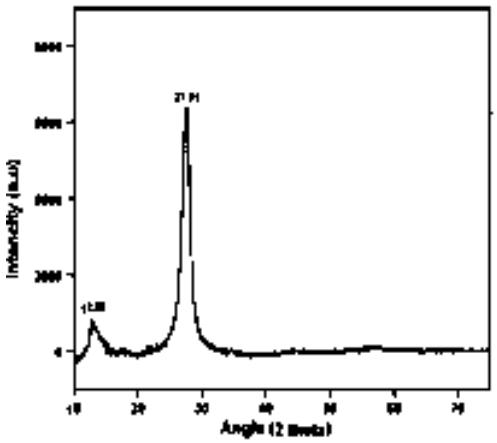
Synthesis of IONPs

The IONPs were synthesised based on method outlined by (Palash Kumar Dhar et al.,2021) with partial modification. 100 ml each of 1M Ferrous ammonium sulphate ($(NH_4)_2Fe(SO_4)_2(H_2O)_6$) and 2M Ferric chloride ($FeCl_3$) solution were prepared in deionized water and mixed well.100 ml of the extract was added to this solution mixture. About 10 ml of 10 % Sodium hydroxide (NaOH) was added slowly with continuous stirring until the precipitate was formed. The solution was irradiated in MW oven at 2.45 GHz under 420 W for about 2 minutes and was allowed to cool at room temperature. Further, the precipitate was filtered using Whatmann 40 filter paper and washed several times with deionized water to avoid impurities. Finally the obtained product (IONPs) was subjected to oven dry at 100◦C for 1 hour.

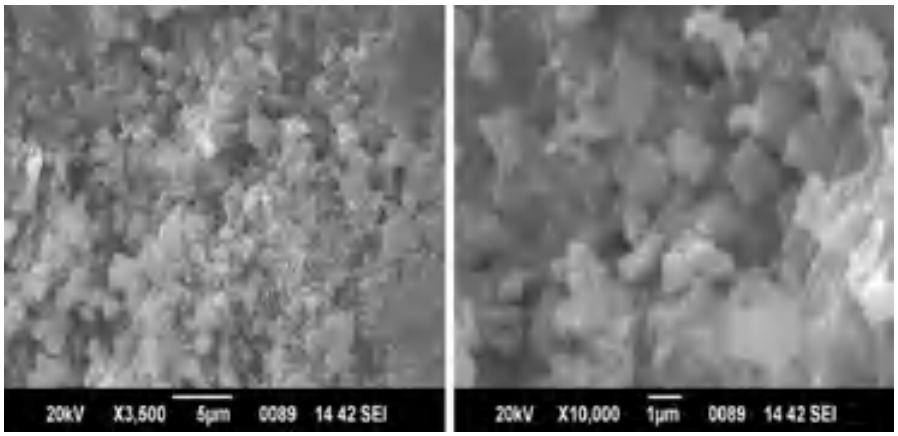
8. Observations and Results:

a)FT-IR Spectroscopy **b) XRD**

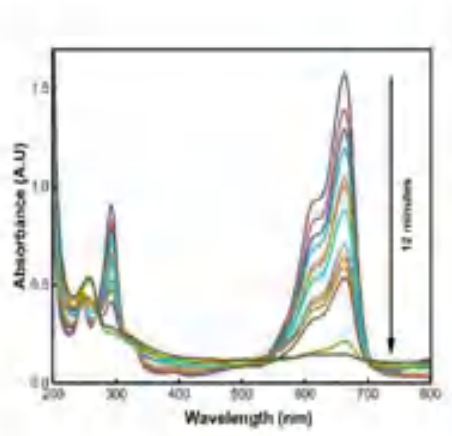


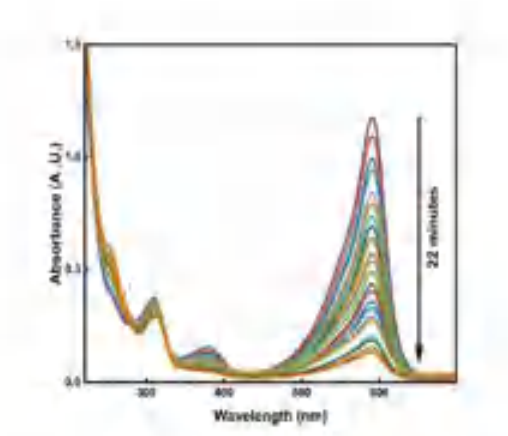


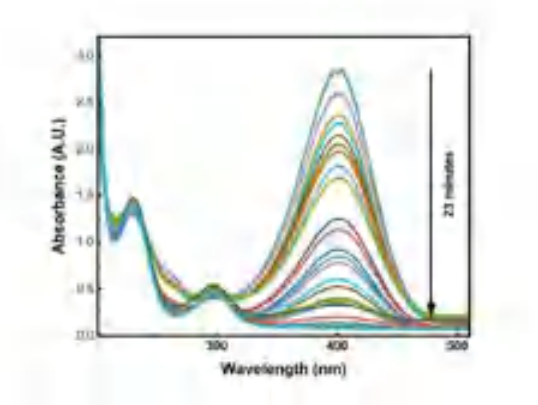
C) Scanning electron microscopy



d)Catalytic activity:







e)Antibacterial study:

9. Discussion:

In the FTIR spectrum of green-synthesized IONPs , the broad band at around 3400-3200 cm^{-1} corresponds to the O-H stretching vibration of hydroxyl groups present in the biomolecules used as reducing agents and stabilizers. The peaks at around 2920 cm^{-1} and 2850 cm^{-1} correspond to the C-H stretching vibration of the aliphatic hydrocarbon chains in the biomolecules. The peak at around 1628 cm^{-1} corresponds to the C=O stretching vibration of the carbonyl group present in the biomolecules. The spectrum featured a sharp peak at approximately 600 cm^{-1}, which corresponded to the characteristic stretching vibration of the Fe-O bond in the iron oxide nanoparticles. These peaks confirm the presence of iron oxide nanoparticles in the sample.

In the X-ray diffraction (XRD) study of IONPs, it was observed that the nanoparticles contained both hematite and magnetite phases. The XRD pattern showed the characteristic peaks of hematite and magnetite phases, which were identified using their respective crystal phases and Miller indices. The peaks for hematite were observed at 2θ values of 24.27°, 33.17°, 35.93°, 41.22°, 49.53°, 56.88°, 62.62° and 64.29°, while the peaks for magnetite were also observed with low intensity at 2θ values of 30.14°, 35.56°, 43.12°, 53.44°, 57.18°, 62.66°, 66.36° and 74.46°. The weak magnetic properties of the IONPs were attributed to the small size of the nanoparticles and the presence of hematite phase, which is known to have low magnetic moment.

The scanning electron microscopy (SEM) study of IONPs revealed that they had a distorted cube-like morphology with an average size of below 100 nm. The nanoparticles showed irregular shapes with sharp edges and corners. The SEM images showed a significant degree of agglomeration among the nanoparticles, indicating the tendency of the nanoparticles to form clusters. The small size of the nanoparticles is beneficial for their enhanced reactivity and surface area, which can increase

their efficiency in various applications. The distorted cube-like morphology of the nanoparticles can also enhance their surface area, making them more accessible to reactants and increasing their catalytic activity.

In this study, we investigated the potential of iron oxide nanoparticles (IONPs) as a heterogeneous catalyst for the borohydride-assisted reduction of methylene blue, bromophenol blue, and ortho-nitrophenol. The progress of the catalytic process was followed by UV –Visible spectroscopy and observed spectra for MB, bromophenol blue, and O-nitrophenol. The results showed that the IONPs were able to efficiently catalyse the reduction of all three dyes, resulting in significant reduction in colour within short reaction times.

The antibacterial activity of green-synthesized IONPs against E. coli was investigated. The results showed that the IONPs exhibited antibacterial activity against E. coli, albeit with a smaller zone of inhibition of 8 mm. Despite the smaller zone of inhibition observed in this study, the antibacterial activity of the green-synthesized IONPs against E. coli is still significant.

This project report presents a study on the microwave-assisted green synthesis of iron oxide nanoparticles and their characterizations. The results of the FTIR, XRD, SEM, and EDAX characterizations confirmed the successful synthesis of pure and highly crystalline iron oxide nanoparticles. The synthesized nanoparticles also exhibited excellent catalytic activity in the reductive degradation of Methylene blue, Bromophenol, and o-nitrophenol. Additionally, the nanoparticles showed significant antibacterial activity against E-coli, making them a potential material for biomedical and pharmaceutical applications.This study demonstrates the potential of iron oxide nanoparticles as a versatile and efficient material with various applications in science and technology.

10. Acknowledgement: We are grateful to Government of Kerala for providing financial assistanceto this project through ASPIRE scholarship, 2022-23. We specially express our gratitude to St. Teresa's College, Ernakulam for providing necessary facilities and support to carry out this work.

11. Bibliography:

[1] Roco, M. C. (1999). Nanoparticles and nanotechnology research. *Journal of Nanoparticle Research*, *1*(1), 1.

[2] Teja, A. S., & Koh, P. Y. (2009). Synthesis, properties, and applications of magnetic iron oxide nanoparticles. *Progress in crystal growth and characterization of materials*, *55*(1-2), 22-45.

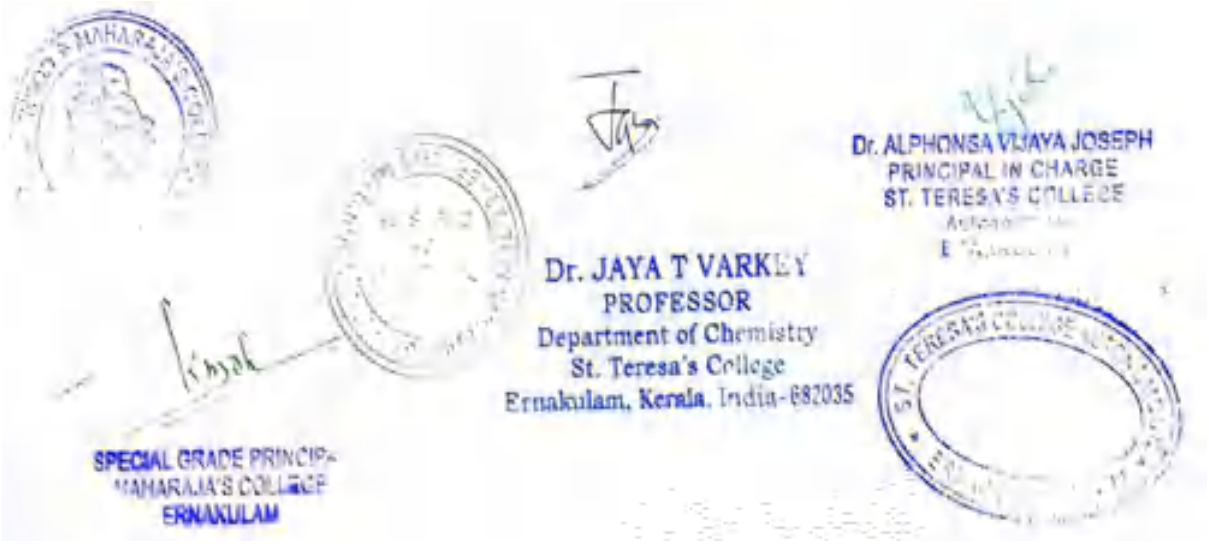
[3] Bano, S., Nazir, S., Nazir, A., Munir, S., Mahmood, T., Afzal, M., ... & Mazhar, K. (2016). Microwave-assisted green synthesis of superparamagnetic nanoparticles using fruit peel extracts: surface engineering, T2 relaxometry, and photodynamic treatment potential. *International Journal of Nanomedicine*, *11*, 3833.

[4] Kumar, B., Smita, K., Cumbal, L., Debut, A., Galeas, S., & Guerrero, V. H. (2016). Phytosynthesis and photocatalytic activity of magnetite (Fe3O4) nanoparticles using the Andean blackberry leaf. *Materials Chemistry and Physics*, *179*, 310-315.

[5] Dhar, P. K., Saha, P., Hasan, M. K., Amin, M. K., & Haque, M. R. (2021). Green synthesis of magnetite nanoparticles using Lathyrus sativus peel extract and evaluation of their catalytic activity. *Cleaner Engineering and Technology*, *3*, 100117.

[6] Nair, G. M., Sajini, T., & Mathew, B. (2022). Advanced green approaches for metal and metal oxide nanoparticles synthesis and their environmental applications. *Talanta Open*, *5*, 100080.

12. Feedback: Synthesis of a trending class of compound was indeed a great experience and this project paved base for the future works.



No.

Institution Address

Joining report

Ref: SI/1099/2023/DCE .....Dated....18/03/2023

As per the reference cited above,.....ATHULYA M K

(MADHUKUNNUMMAL HOUSE KAKKATTIL P.O KAKKATTIL , 673507, KOZHIKODE , KERALA)...has joined in the maharajas college .....with effect from 24/03/23 for doing internship of Aspire scholarship

Principal /Hod/Address of the institution

SPECIAL GRADE PRINCIPAL
MAHARAJA'S COLLEGE
ERNAKULAM

(Office seal)

Date 24/03/2023

Project Guide

Dr. NEENA GEORGE
Assistant Professor
Department of Chemistry
Maharaja's College, Ernakulam 682011

No.

Institution Address

Joining report

51/1099/2023 DCE

Ref: .....Dated....18/3/2023

As per the reference cited above,.....SAMAJA P R

(PUTHENPURAYIL HOUSE ,THALACODE P.O ,MULANTHURUTHY , ERNAKULAM, 682314 , KERALA)...has joined in the maharajas college .....with effect from 22/03/23 for doing internship of Aspire scholarship.

DR. SEENA E. B.
(PEN - 514980)
Assistant Professor
Department of Chemistry
Maharaja's College, Ernakulam-682 011

Principal /Hod/Address of the institution
SPECIAL GRADE PRINCIPAL
MAHARAJA'S COLLEGE
ERNAKULAM

(Office seal)

Date 22/03/2023

MAHARAJA'S COLLEGE ERNAKULAM * COCHIN-682 011 *