

# **FABRICATION OF MAGNESIUM- ION CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND MAGNESIUM NITRATE HEXAHYDRATE**

A dissertation Submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfilment of the requirement for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**Ms. J. AGNES (Register No:2021MSCP01)**

## **External Guide**

**Dr .S. SELVASEKARAPANDIAN**

Director,  
Materials Research Center,  
Coimbatore &  
Emeritus Professor,  
Bharathiar University,  
Coimbatore.

## **Internal Guide**

**Dr .L. CAROLINE SUGIRTHAM**

Associate Professor,  
Research Centre of Physics,  
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Madurai.



**RESEARCH CENTRE OF PHYSICS  
FATIMA COLLEGE (AUTONOMOUS)  
(RE-ACCREDITED WITH 'A<sup>++</sup>' GRADE BY NAAC)  
MARY LAND, MADURAI-625018**

**APRIL 2023**

## BONAFIDE CERTIFICATE

This is to certify that the project report entitled "FABRICATION OF MAGNESIUM-ION CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND MAGNESIUM NITRATE HEXAHYDRATE" is submitted to Fatima college, Madurai in partial fulfilment for the award of the degree of MASTER OF SCIENCE IN PHYSICS. This is the record of original project work done by J.AGNES at Materials Research Center, Madurai under the guidance of Dr.S. SELVASEKARAPANDIAN, Director, Materials Research Center, Coimbatore and Emeritus professor, Bharathiar University, Coimbatore and Dr.L.CAROLINE SUGIRTHAM, Associate professor, Research Centre of Physics, Fatima college, Madurai and submitted to Research Centre of Physics, Fatima College, Madurai.

*S. Selvaselvarapandian*

Dr .S. Selvasekarapandian

Director,

Materials Research Center,

Coimbatore &

Emeritus Professor,

Bharathiar University,

Coimbatore.

*L. Caroline Sugirtham*

Dr. L. Caroline Sugirtham

Associate Professor,

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Madurai.

*A. Sheela Vimala Rani*

Dr. A. Sheela Vimala Rani

Head & Associate Professor,

Research Centre of Physics,

Fatima College,

Madurai.

## DECLARATION

I do hereby declare that this dissertation entitled "**FABRICATION OF MAGNESIUM -ION CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND MAGNESIUM NITRATE HEXAHYDRATE**" has been carried out by **J. AGNES** (Reg.No:2021MSCP01) and submitted to Research Centre of Physics, Fatima College, Madurai in a partial fulfilment of the requirements for the award of **MASTER OF SCIENCE IN PHYSICS**, during the academic year, 2021-2023.

Place: Madurai

Date: 05.04.2023



**J. AGNES**

**REG.NO:2021MSCP01**

**II M.Sc. PHYSICS,  
FATIMA COLLEGE,  
MARY LAND,  
MADURAI-18.**

## ACKNOWLEDGEMENT

### "GLORY TO GOD ALMIGHTY WHO GIVES US THE VICTORY"

We are grateful to **Dr. Sr. G. CELINE SAHAYA MARY**, Principal, Fatima College, Madurai for permitting us to carry out our project at Materials Research Centre, Madurai and also, I would like to thank **Dr. Sr. M. FRANCISCA FLORA**, Secretary, Fatima College, Madurai for her prayers and blessings.

I thank **Dr. A. SHEELA VIMALA RANI**, Head and Associate professor, Research Centre of Physics, Fatima College, Madurai for her constant support and encouragement in the successful completion of this project work.

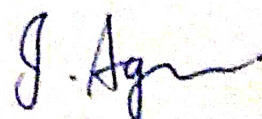
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We acknowledge project fund received under **DST CURIE** core Grant for Women PG Colleges **DST/CURIE-PG/2022/11**.

I thank **S. AAFRIN HAZAANA, N. MUNIRAJ@VIGNESH, R. MEERA NAACHIYAR, M. KANI AJAY BABU & P. MOHANAA MUTHUSELVI**, Research Scholars, Materials Research Center, Madurai for their constant support throughout this project work.

I thank my beloved parents **Mr. S. JOE RATHINAM** and **Mrs. J. ANTONY SAHAYA HELEN** for their motivation and support during this project & for giving me strength to chase my dreams. And also I would like to thank my friends for their valuable support.

  
(J.AGNES)

**OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH BARIUM OXIDE  
AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**ARUNAASHREE V (Reg.No.2021MSCP02)**

External Guide & Internal Guide

**Dr. ANCEMMA JOSEPH, M.Sc., Ph.D.**

Assistant Professor, Research Centre of Physics,

Fatima College, Madurai.



**FATIMA COLLEGE (AUTONOMOUS)**

(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)

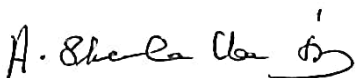
Mary Land

MADURAI – 625 018


April 2023

## CERTIFICATE

This is to certify that the project work entitled “OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH BARIUM OXIDE AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION” submitted by ARUNAASHREE V (Reg.No.2021MSCP02) under the guidance of Dr. Ancemma Joseph, Assistant Professor, Research centre of Physics, Fatima College, Madurai. This work has been completed successfully towards the partial fulfillment of requirements for the award of the Degree of Master of Science in Physics DURING THE ACADEMIC YEAR 2021-2023.

  
(Dr.A.Sheela Vimala Rani),

Head & Associate Professor,  
Research Centre of Physics,  
Fatima College,  
Madurai.

  
(Dr.Ancemma Joseph),

Assistant Professor,  
Research Centre of Physics,  
Fatima College,  
Madurai.

## DECLARATION

I hereby declare that the dissertation titled **“OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH BARIUM OXIDE AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION”** submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for awarded of the degree of Master of Science in Physics is a record of original project ARUNAASHREE V (Reg.No: 2021MSCP02) under the guidance of Dr.Ancemma Joseph, Assistant Professor, Research Center of Physics, Fatima College, Madurai.

## ACKNOWLEDGEMENT

This academic pursuit drew inspiration from many sources. It is present Privilege to place my sincere gratitude to one and all who inspired and helped in this endeavor on the report. At the outset, I submit by heartfelt sincere, humble gratitude to the GOD ALMIGHTY, who has given strength for the successful completion of my course.

I wish to express my profound gratitude to Dr. Sr. G. Celine Sahaya Mary, Principal, Fatima College, for permitting me to do the project work at PG level.

I convey my heartfelt thanks to Dr. Ancemma Joseph, Assistant Professor, Research centre of Physics, Fatima College, Madurai for her excellent guidance constant encouragement, valuable ideas and deep concern to help to all along my project work.

I express my deep sense of gratitude to Dr. A. Sheela Vimala Rani, Head, Research Centre of Physics for her wise counsel, sincere and valuable suggestion throughout my project work.

I feel happy indebted to all faculty Member of Department of Physics, Fatima college, who provided their support, inspiration and suggestion to prepare this report.

I wish to express my deep sense of gratitude and indebtedness to Dr. K. Marimuthu, Assistant Professor, Department of Physics, The Gandhigram Rural Institute-Deemed to be University, Gandhigram for his esteemed guidance, invaluable help and fruitful suggestions throughout the course of my work.

I offer most sincere and humble gratitude to my beloved Parents who vested keen interest and kind encouragement in the progress and helped us financially.

I express my sincere thanks to my friends and my classmates for their moral support encouragement for my project work.

**I sincerely acknowledge project fund received under DST CURIE core Grant for Women PG colleges DST/CURIE-PG/2022/11**

*Arunaashree V*  
(ARUNAASHREE.V)

**OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH LITHIUM OXIDE  
AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**BATRICKS JEENA M (Reg.No.2021MSCP03)**

External Guide & Internal Guide

**Dr. ANCEMMA JOSEPH, M.Sc., Ph.D.**

Assistant Professor, Research Centre of Physics,

Fatima College, Madurai.



**FATIMA COLLEGE (AUTONOMOUS)**

(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)

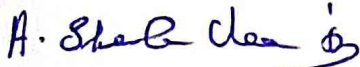
Mary Land

MADURAI – 625 018

April 2023

## CERTIFICATE

This is to certify that the project work entitled “OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH LITHIUM OXIDE AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION” submitted by **BATRICKS JEENA M** (Reg.No.2021MSCP03) under the guidance of **Dr. Ancemma Joseph**, Assistant Professor, Research centre of Physics, Fatima College, Madurai. This work has been completed successfully towards the partial fulfillment of requirements for the award of the Degree of Master of Science in Physics DURING THE ACADEMIC YEAR 2021-2023.

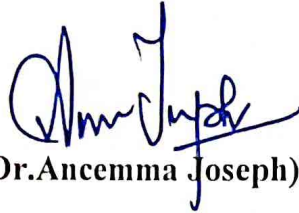


(Dr.A.SheelaVimala Rani),

Head, Research Centre of Physics,

Fatima College,

Madurai.



(Dr.Ancemma Joseph),

Assistant Professor,

Fatima College,

Madurai.

## **DECLARATION**

I hereby declare that the dissertation titled **“OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH LITHIUM OXIDE AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION”** submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for awarded of the degree of Master of Science in Physics is a record of original project **BATRICKS JEENA M** (Reg.No: 2021MSCP03) under the guidance of Dr.Ancemma Joseph, Assistant Professor, Research Center of Physics, Fatima College, Madurai.

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**I sincerely acknowledge project fund received under DST CURIE core Grant for Women PG colleges DST/CURIE-PG/2022/11**

*U. Batricks Jeena*  
(BATRICKS JEENA. M)

# **SYNTHESIS AND CHARACTERIZATION OF Ni-Co OXIDE IN WATERSPLITTING**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

In partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**BENCIA IMMACULATE J (Reg.No.2021MSCP04)**

External Guide

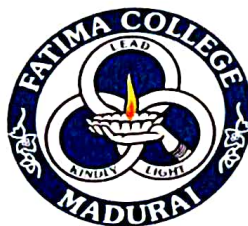
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Assistant Professor, Alagappa University, Science Campus, Karaikudi.

Internal Guide

**Dr. Ms. I. JANET SHERLY, M.Sc., M.Phil., Ph.D.**

Assistant Professor, Research Centre of Physics, Fatima College, Madurai.



**FATIMA COLLEGE (AUTONOMOUS)**

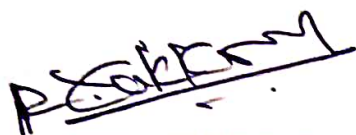
**(RE-ACCREDITED WITH 'A++' BY NAAC)**

Mary Land, Madurai – 625 018.

April 2023

## CERTIFICATE

This is to certify that the project work entitled "SYNTHESIS AND CHARACTERIZATION OF Ni-Co OXIDE IN WATERSPLITTING" submitted by **BENCIA IMMACULATE J** (Reg.No:2021MSCP04) under the guidance of **Dr. R. YUVAKKUMAR**, Assistant Professor, Alagappa University, Science Campus, Karaikudi is submitted to Department of Physics, Fatima College. This work has been completed successfully towards the partial fulfilment of requirements for the award of the Degree of Master of Science in Physics during the academic year 2021-2023.



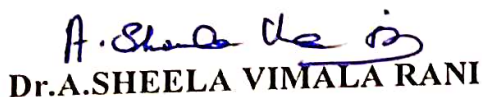
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Assistant Professor,  
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**Dr. I. JANET SHERLY**

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**Dr.A.SHEELA VIMALA RANI**

(Head & Associate Professor)  
Research Centre of Physics,  
Fatima College,  
Madurai.

## DECLARATION

I hereby declare that the dissertation titled “**SYNTHESIS AND CHARACTERIZATION OF Ni-Co OXIDE IN WATERSPLITTING**” submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for the award of the degree of Master of Science in Physics is a record of original project done by **BENCIA IMMACULATE J** (Reg No: 2021MSCP04) under the guidance of Dr. I .JANET SHERLY, Assistant Professor, Research Center of Physics, Fatima College, Madurai.

Place: Madurai

Date: 05.04.2023

*J. Bencia Immaculate*  
**J. BENCIA IMMACULATE**  
(2021MSCP04)

## ACKNOWLEDGEMENT

This academic pursuit drew inspiration from many sources. It is present Privilege to place my sincere gratitude to one and all who inspired and helped in this endeavour on the report. At the outset, I submit by heartfelt sincere, humble gratitude to the GOD ALMIGHTY, who has given strength for the successful completion of my course.

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We acknowledge project fund received under DST CURIE core Grant for Women PG Colleges DST/CURIE-PG/2022/11.

*J. Bençia Immaculate*  
(BENCIA IMMACUALTE.J)

# **SYNTHESIS AND CHARACTERIZATION OF ZINC OXIDE/REDUCED GRAPHENE OXIDE (ZNO/rGO) USING CHEMICAL PRECIPITATION TECHNIQUE.**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To Partial Fulfillment of requirements for the award of the degree of

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**FAHEERA PARVEEN . N ( Reg . No: 2021MSCP05)**

External Guide

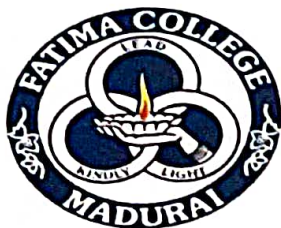
**Dr. R. Selvarajan M. Tech PhD Teaching Fellow**

Centre for Nano Science and Technology, A.C.Tech Campus, Anna University

Internal Guide

**Dr .A .Sheela Vimala Rani**

Head & Associate Professor, Research center of physics, Fatima College, Madurai



**FATIMA COLLEGE (AUTONOMOUS)**

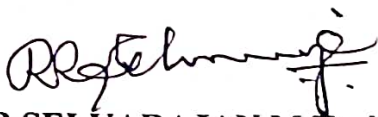
**RE-ACCREDITED WITH 'A++' BY NAAC**

Mary Land, Madurai -625 018.

April 2023

## **BONAFIDE CERTIFICATE**

This is to certify that the work continued in the thesis entitled “SYNTHESIS AND CHARACTERIZATION OF ZINC OXIDE/ REDUCED GRAPHENE OXIDE (ZnO /rGO) NANOCOMPOSITE BY CHEMICAL PRECIPITATION APPROACH” is submitted to Fatima College, Madurai in fulfilment for the award of the degree of Master of Science in Physics. This is the record of original Project work done by **Ms. FAHEERA PARVEEN. N, 2021MSCP05**, II-MSc Physics at **Centre for Nanoscience and Technology, Anna University, Chennai-600025** under the guidance of **Dr R.SELVARAJAN M.Tech., Ph.D** Centre for Nanoscience and Technology , A.C.Tech Campus , Anna University, Chennai-600 025 and **Dr. A. SHEELA VIMALA RANI** , Associate Professor and Head, Research Centre of Physics, Fatima College, Madurai during December 2022 –January 2023.



**Dr R.SELVARAJAN M.Tech., Ph.D**  
Teaching Fellow,  
Centre for Nanoscience and Technology,  
A.C.Tech Campus,  
Anna University, Chennai-600 025.



**Dr. A. SHEELA VIMALA RANI**  
Associate Professor and Head,  
Research Centre of Physics,  
Fatima College(autonomous),  
Madurai-625018.

## DECLARATION

---

I hereby declare that the project work in this thesis entitled “**SYNTHESIS AND CHARACTERIZATION OF ZINC OXIDE/REDUCED GRAPHENE OXIDE (ZnO/rGO) USING CHEMICAL PRECIPITATION TECHNIQUE**” submitted to Fatima College in partial fulfillment of the requirements for the award of the degree “**Master of Science in Physics**”, is the record of original Project work done by me for under the guidance of Dr. A. Sheela Vimala Rani, Head and Associate Professor, Research Centre of Physics, Fatima College, Madurai. and Dr. R. Selvarajan, (Nano Science and Technology), M. Tech PhD, Teaching Fellow, Centre for Nano science and Technology, AC Tech Campus, Anna University, Chennai. It has not been submitted for the award of any Degree/Diploma in Madurai Kamaraj University or any other university/institutions.

Place: *Madurai*

Date: *05.04.2023*

  
N. FAHEERA PARVEEN

(2021MSCPO5)

**FABRICATION OF SODIUM ION CONDUCTING BATTERY WITH  
BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON  
AZADIRACHTA INDICA (NEEM LEAF) AND SODIUM NITRITE**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai )

To partial fulfilment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**Ms. R. JESLINE FELSIA** (Register No: 2021MSCP07)

**EXTERNAL GUIDE**

**Dr. S. SELVASEKARAPANDIAN**

Director,

Materials Research Center,

Coimbatore &

Emeritus Professor,

Bharathiar University,

Coimbatore.

**INTERNAL GUIDE**

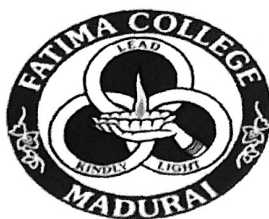
**Dr. I. JEYA SHEELA**

Assistant Professor,

Research Centre of Physics

Fatima College,

Madurai.



**RESEARCH CENTRE OF PHYSICS**

**FATIMA COLLEGE (AUTONOMOUS)**

(RE-ACCREDITED WITH 'A<sup>++</sup>' GRADE BY NAAC)

**MARY LAND, MADURAI – 625018**

**APRIL 2023**

## BONAFIDE CERTIFICATE

This is to certify that the project report entitled "**FABRICATION OF SODIUM ION BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND SODIUM NITRITE**" submitted to Fatima College, Madurai in partial fulfilment for the award of the degree of **MASTER OF SCIENCE IN PHYSICS**. This is the record of original project work done by **R.JESLINE FELSIA** at Materials Research Center, Madurai under the guidance of **Dr. S. SELVASEKARAPANDIAN**, Director, Materials Research Center, Coimbatore and Emeritus Professor, Bharathiar University, Coimbatore and **Dr. I. JEYA SHEELA**, Assistant Professor, Research Centre of Physics, Fatima College, Madurai and submitted to Research Centre of Physics, Fatima College, Madurai.

  
**Dr. S. SELVASEKARAPANDIAN**

Director,  
Materials Research Center,  
Coimbatore &  
Emeritus Professor,  
Bharathiar University,  
Coimbatore.

  
**Dr. I. JEYA SHEELA**

Assistant Professor,  
Research Centre of Physics,  
Fatima College,  
Madurai.

  
**Dr. A. SHEELA VIMALA RANI**

Head & Associate Professor,  
Research Centre of Physics,  
Fatima College,  
Madurai.

## DECLARATION

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Place: Madurai

Date: 05.04.2023

*R. Jesline Felsia*

**R. JESLINE FELSIA**

Reg.No:2021MSCP07

II M.Sc. PHYSICS,

FATIMA COLLEGE,

MARY LAND,

MADURAI-18.

## ACKNOWLEDGEMENT

### “GLORY TO GOD ALMIGHTY WHO GIVES US THE VICTORY”

We are grateful to **Dr. Sr. G. CELINE SAHAYA MARY**, Principal, Fatima College, Madurai for permitting us to carry out our project at Materials Research Centre, Madurai, and also, I would like to thank **Dr. Sr. M. FRANCISCA FLORA**, Secretary, Fatima College, Madurai for her prayers and blessings.

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I thank my beloved parents **Mr. S. RAJA EDISON** and **Mrs. S. AROCKIA SELVI** for their motivation during this project and friends for their valuable support.

*R. Jesline Felsia*  
(R. JESLINE FELSIA)

# **SYNTHESIS AND CHARACTERIZATION OF DOUBLE PEROVSKITE $\text{La}_2\text{NiMnO}_6$ (LNMO)**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfilment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

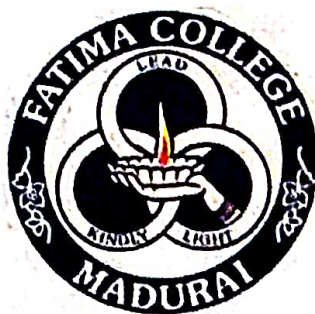
**JOYCE JESINTHA M (Reg.No.2021MSCP08)**

External Guide & Internal Guide

**Dr. M. RAGAM, M.Sc., M.Phil., Ph.D.**

Assistant Professor, Research Centre of Physics,

Fatima College, Madurai.



**FATIMA COLLEGE (AUTONOMOUS)**

(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)

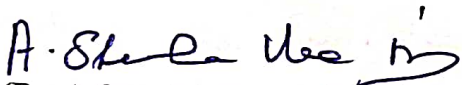
Mary Land


MADURAI – 625 018

April 2023

## CERTIFICATE

This is to certify that the project work entitled “SYNTHESIS AND CHARACTERIZATION OF DOUBLE PEROVSKITE  $\text{La}_2\text{NiMnO}_6$  (LNMO) ” submitted by JOYCE JESINTHA M (Reg.No.2021MSCP08) under the guidance of Dr.M.RAGAM, Assistant Professor, Research centre of Physics, Fatima College, Madurai. This work has been completed successfully towards the partial fulfilment of requirements for the award of the Degree of Master of Science in Physics DURING THE ACADEMIC YEAR 2021-2023.

  
(Dr.A.Sheela Vimala Rani),  
Head, Research Centre of Physics,  
Fatima College,  
Madurai.

  
(Dr.M.Ragam),  
Assistant Professor,  
Fatima College,  
Madurai.

## DECLARATION

I hereby declare that the dissertation titled “**SYNTHESIS AND CHARACTERIZATION OF DOUBLE PEROVSKITE  $\text{La}_2\text{NiMnO}_6$  (LNMO)**” submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for awarded of the degree of Master of Science in Physics is a record of original project JOYCE JESINTHA M (Reg No: 2021MSCP08) under the guidance of Dr. M. RAGAM, Assistant Professor, Research Center of Physics, Fatima College, Madurai.

M. Jha.

## ACKNOWLEDGEMENT

This academic pursuit drew inspiration from many sources. It is present Privilege to place my sincere gratitude to one and all who inspired and helped in this endeavour on the report. At the outset, I submit by heartfelt sincere, humble gratitude to the GOD ALMIGHTY, who has given strength for the successful completion of my course.

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I convey my heartfelt thanks to Dr. M. Ragam, Assistant Professor, Research centre of Physics, Fatima College, and Madurai for her excellent guidance constant encouragement, valuable ideas and deep concern to help to all along my project work.

I express my deep sense of gratitude to Dr. A. SheelaVimala Rani, Head, and Research Centre of Physics for her wise counsel, sincere and valuable suggestion throughout my project work.

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I sincerely acknowledge project fund received under DST CURIE core Grant for Women PG colleges DST/CURIE-PG/2022/11

# **OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH STRONTIUM OXIDE AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

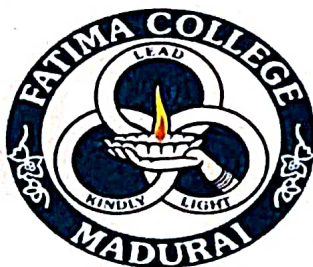
**KOWSALYA R (Reg.No.2021MSCP10)**

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**Dr. ANCEMMA JOSEPH, M.Sc., Ph.D.**

Assistant Professor, Research Centre of Physics,

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(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)

Mary Land

MADURAI – 625 018


April 2023

## CERTIFICATE

This is to certify that the project work entitled “**OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH STRONTIUM OXIDE AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION**” submitted by **KOWSALYA R (Reg.No.2021MSCP10)** under the guidance of **Dr. Ancemma Joseph**, Assistant Professor, Research centre of Physics, Fatima College, Madurai. This work has been completed successfully towards the partial fulfillment of requirements for the award of the Degree of Master of Science in Physics DURING THE ACADEMIC YEAR 2021-2023.

  
(Dr.A.SheelaVimala Rani),

Head & Associate Professor,  
  
Research Centre of Physics,  
  
Fatima College,  
  
Madurai.

  
(Dr.Ancemma Joseph),

Assistant Professor,  
  
Research Centre of Physics,  
  
Fatima College,  
  
Madurai.

## **DECLARATION**

I hereby declare that the dissertation titled **“OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH STRONTIUM OXIDE AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION”** submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for awarded of the degree of Master of Science in Physics is a record of original project KOWSALYA R (Reg.No: 2021MSCP10) under the guidance of Dr.Ancemma Joseph, Assistant Professor, Research Center of Physics, Fatima College, Madurai.

## ACKNOWLEDGEMENT

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**I sincerely acknowledge project fund received under DST CURIE core Grant for Women PG colleges DST/CURIE-PG/2022/11**

*D. Kowsalya*  
(KOWSALYA R)

# **FABRICATION OF ZINC-ION CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE ASELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND ZINC NITRATE**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfilment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**Ms. T. LIBIYAVINNARASI**

**(Register No: 2021MSCP11)**

## **EXTERNAL GUIDE**

**Dr. S. Selvasekarapandian**

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Materials Research Center,

Coimbatore &

Emeritus Professor,

Bharathiar University,

Coimbatore.

## **INTERNAL GUIDE**

**Dr. L. Caroline Sugirtham**

Associate Professor,

Research Centre of Physics

Fatima College

Madurai.



**RESEARCH CENTRE OF PHYSICS**

**FATIMA COLLEGE (AUTONOMOUS)**

(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)

**MARY LAND, MADURAI-625018**

**APRIL 2023**

## BONAFIDE CERTIFICATE

This is to certify that, the project report entitled "FABRICATION OF ZINC-ION CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND ZINC NITRATE" submitted to Fatima College Madurai in partial fulfilment for the award of the degree of MASTER OF SCIENCE IN PHYSICS. This is the record of original project work done by T. LIBIYAVINNARASI at Materials Research Center, Madurai under the guidance of Dr. S. SELVASEKARAPANDIAN, Director, Materials Research Center, Coimbatore and Emeritus Professor, Bharathiar University, Coimbatore and Dr. L. CAROLINE SUGIRTHAM, Associate professor, Research Centre of Physics, Fatima College, Madurai and submitted to Research Centre of Physics, Fatima College, Madurai.

*S. Selvasekarapandian*

**Dr. S. Selvasekarapandian**

Director

Materials Research Center,

Coimbatore &

Emeritus Professor,

Bharathiar University,

Coimbatore.

*L. Caroline Sugirtham*

**Dr. L. Caroline Sugirtham**

Associate Professor,

Research Centre of Physics

Fatima College

Madurai

*A. Sheela Vimala Rani*

**Dr. A. Sheela Vimala Rani**

Head & Associate Professor,

Research Centre of Physics,

Fatima College,

Madurai.

## DECLARATION

I do hereby declare that this dissertation entitled “FABRICATION OF ZINC-ION CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND ZINC NITRATE” has been carried out by **T. LIBIYAVINNARASI** (Reg.No:2021MSCP11) and submitted to Research Centre of Physics, Fatima College, Madurai in a partial fulfilment of the requirements for the award of **MASTER OF SCIENCE IN PHYSICS**, during the academic year, 2021 – 2023.

Place: Madurai

Date: 05.04.2023

*T. Libiyavinnarasi*

**T.LIBIYAVINNARASI**

Reg.No:2021MSCP11

II M.Sc .PHYSICS,

FATIMA COLLEGE,

MARY LAND,

MADURAI-18.

**SYNTHESIS AND CHARACTERIZATION OF MgO, MgO/CNT AND Ni-MgO/CNT  
FOR SUPERCAPACITOR APPLICATION**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

In partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**MARIA JASMINE SHINY A (Reg.No.2021MSCP12)**

External Guide

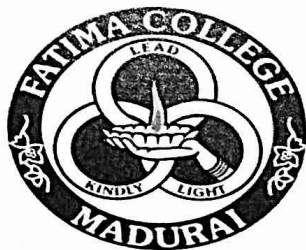
**Dr. R. YUVAKKUMAR, M.A./M.Sc./M.Ed./M.Phil./Ph.D./**

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Internal Guide

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Assistant Professor, Research Centre of Physics, Fatima College, Madurai.



**FATIMA COLLEGE (AUTONOMOUS)**

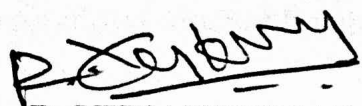
(RE-ACCREDITED WITH 'A++' BY NAAC)

Mary Land, MADURAI – 625 018.

April 2023

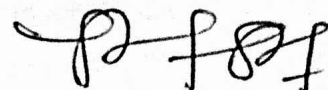
## CERTIFICATE

This is to certify that the project work entitled "SYNTHESIS AND CHARACTERIZATION OF MgO/CNT AND Ni-MgO/CNT IN SUPER CAPACITOR APPLICATIONS" submitted by MARIA JASMINE SHINY A (Reg.No:2021MSCP12) under the guidance of Dr. R. YUVAKKUMAR, Assistant Professor, Alagappa University, Science Campus, Karaikudi is submitted to Department of Physics, Fatima College. This work has been completed successfully towards the partial fulfilment of requirements for the award of the Degree of Master of Science in Physics during the academic year 2021-2023.



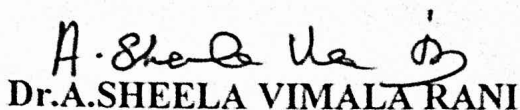
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Assistant Professor,  
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Dr. I. JANET SHERLY

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Research Centre of Physics,  
Fatima College,  
Madurai.



(Head & Associate Professor)  
Research Centre of Physics,

Fatima College,  
Madurai.

### DECLARATION

I hereby declare that the dissertation titled ““SYNTHESIS AND CHARACTERIZATION OF MgO, MgO/CNT AND Ni-MgO/CNT IN SUPERCAPACITOR” submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for the awarded of the degree of Master of Science in Physics is a record of original project MARIA JASMINE SHINY A (Reg No:2021MSCP12) under the guidance of Dr. I .JANET SHERLY, Assistant Professor, Research Center of Physics, Fatima College, Madurai and Dr. R.YUVAKKUMAR, Assistant Professor, Alagappa University, Science Campus, Karaikudi. It has not been submitted for the award of any Degree/Diploma in Madurai Kamaraj University or any other university/institutions.

*A. Maria Jasmine Shiny*

Place: Madurai

A.MARIA JASMINE SHINY

Date: 05.04.2023

(2021MSCP12)

## ACKNOWLEDGEMENT

This academic pursuit drew inspiration from many sources. It is present Privilege to place my sincere gratitude to one and all who inspired and helped in this endeavor on the report. At the outset, I submit by heartfelt sincere, humble gratitude to the GOD ALMIGHTY, who has given strength for the successful completion of my course.

I wish to express my profound gratitude to Dr. Sr. G. CELINE SAHAYA MARY, Principal, Fatima College, for permitting me to do the project work at PG level.

I convey my heartfelt thanks to Dr. I. JANET SHERLY, Assistant Professor, Research Centre of Physics, Fatima College, Madurai for her excellent guidance constant encouragement, valuable ideas and deep concern to help to all along my project work.

I am greatly indebted to Dr. R. YUVAKKUMAR , Assistant Professor, Department of Physics, Alagappa University, Science Campus, Karaikudi, for his constant support and supervision throughout the internship work and for initiating my interest in research. I owe a lot to him and express my deep sense of gratitude to him. I considered myself extremely fortunate to get an opportunity to work under him.

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We acknowledge project fund received under DST CURIE core Grant for women PG colleges  
DST/ CURIE-PG/2022/11.

(A.MARIA JASMINE SHINY)

*A. Maria Jasmine Shiny*

**FABRICATION OF PROTON CONDUCTING BATTERY  
WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE  
BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND  
AMMONIUM NITRATE**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfilment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**Ms. F.MARIA SHINOLA**

**(Register No: 2021MSCP13)**

**EXTERNAL GUIDE**

**Dr. S. Selvasekarapandian**

Director,  
Materials Research Center,  
Coimbatore &  
Emeritus Professor,  
Bharathiar University,  
Coimbatore.

**INTERNAL GUIDE**

**Dr. L. Caroline Sugirtham**

Associate Professor,  
Research Centre of Physics  
Fatima College  
Madurai.



**RESEARCH CENTER OF PHYSICS  
FATIMA COLLEGE (AUTONOMOUS)**

**(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)**

MARY LAND, MADURAI-625018

**APRIL 2023**

## BONAFIDE CERTIFICATE

This is to certify that the project report entitled "**FABRICATION OF PROTON CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND AMMONIUM NITRATE**" submitted to Fatima College, Madurai in partial fulfilment for the award of the degree of **MASTER OF SCIENCE IN PHYSICS**. This is the record of original project work done by **F.MARIA SHINOLA** at Materials Research Center, Madurai under the guidance of **Dr. S. SELVASEKARAPANDIAN**, Director, Materials Research Center, Coimbatore and Emeritus Professor, Bharathiar University, Coimbatore and **Dr . L.CAROLINE SUGIRTHAM**, Associate Professor, Research centre of Physics, Fatima college Madurai and Submitted to Department of Physics, Research Centre of Physics, Fatima College, Madurai.

*S. Selvasekarapandian*

**Dr. S. Selvasekarapandian**  
Director,  
Materials Research Center,  
Coimbatore &  
Emeritus Professor,  
Bharathiar University,  
Coimbatore.

*L. Caroline Sugirtham*

**Dr. L. Caroline Sugirtham**  
Associate Professor,  
Research Centre of Physics,  
Fatima College,  
Madurai.

*A. Sheela Vimala Rani*

**Dr. A. Sheela Vimala Rani**  
Head & Associate Professor,  
Research Centre of Physics,  
Fatima College,  
Madurai.

## DECLARATION

I do hereby declare that this dissertation entitled "**FABRICATION OF PROTON CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND AMMONIUM NITRATE**" has been carried out by **F. MARIA SHINOLA** (Reg.No:2021MSCP13) and submitted to Research Centre of Physics, Fatima College, Madurai in a partial fulfilment of the requirements for the award of **MASTER OF SCIENCE IN PHYSICS**, during the academic year 2021-2023.

Place: Madurai

Date: 05.04.2023

*F. Maria Shinola*

**F.MARIA SHINOLA**

Reg.No:2021MSCP13

II M.Sc .PHYSICS,

FATIMA COLLEGE,

MARY LAND,

MADURAI-18.

## ACKNOWLEDGEMENT

### “GLORY TO GOD ALMIGHTY WHO GIVES US THE VICTORY”

We are grateful to **Dr. Sr. G. CELINE SAHAYA MARY**, Principal, Fatima College, Madurai for permitting us to carry out our project at Materials Research Center, Madurai and also, I would like to thank **Dr. Sr. M. FRANCISCA FLORA**, Secretary, Fatima College, Madurai for her prayers and blessings.

I thank **Dr. A. SHEELA VIMALA RANI**, Head and Associate professor, Research Centre of Physics, Fatima College, Madurai for her constant support and encouragement in the successful completion of this project work.

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My indebted thanks to **Dr. L. CAROLINE SUGIRTHAM**, Associate Professor, Research Centre of Physics, Fatima College, for her constructive and sustained interest towards each and every stage of this work and her valuable suggestions throughout my project work.

We acknowledge project fund received under **DST CURIE** core Grant for Women PG Colleges **DST/CURIE-PG/2022/11**.

I thank **S. AAFRIN HAZAANA, N. MUNIRAJ@VIGNESH, R. MEERA NAACHIYAR, M. KANI AJAY BABU, & P. MOHANAA MUTHUSELVI** Research Scholars, Materials Research Center, Madurai for their constant support throughout this project work.

I thank my beloved Mother **Mrs. K. LILY PUSHPAM** for her motivation and support during this project. I thank my Father late **Mr. M. FRANCIS AROCKIA STEPHEN**, for giving me strength to chase my dreams. He will always be in my heart because in there he is still alive. And also I would like to thank my friends for their valuable support.

*F. Maria Shinola*  
(F.MARIA SHINOLA)

# **MAGNETIC PROPERTIES OF BFO-NFO COMPOSITES**

A dissertation submitted to  
**FATIMA COLLEGE (AUTONOMOUS)**  
(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)  
To partial fulfilment of the requirements for the award of the degree  
**MASTER OF SCIENCE IN PHYSICS**

Submitted by  
**M. MONISHA (Reg No:2023MSCP14)**

External Guide & Internal Guide  
**Dr. M. RAGAM, M.Sc., M.Phil., Ph.D.**  
Assistant Professor, Research Centre of Physics,  
Fatima College, Madurai.




**FATIMA COLLEGE (AUTONOMOUS)**  
(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)

Mary Land  
MADURAI – 625 018  
April 2023

## CERTIFICATE

This is to certify that the project work entitled “**MAGNETIC PROPERTIES OF BFO-NFO COMPOSITES**” submitted by **M.MONISHA (Reg.No.2023MSCP14)** under the guidance of **Dr. M.RAGAM**, Assistant Professor, Research centre of Physics, Fatima College, Madurai. This work has been completed successfully towards the partial fulfilment of requirements for the award of the Degree of Master of Science in Physics DURING THE ACADEMIC YEAR 2022-2023.

  
(Dr.A.Sheela Vimala Rani),

Head, Research Centre of Physics,  
Fatima College,  
Madurai.

  
(Dr.M.Ragam),

Assistant Professor,  
Fatima College,  
Madurai.

## DECLARATION

I hereby declare that the dissertation titled **“INVESTIGATIONS ON BFO-NFO COMPOSITES FOR MAGNETIC ENERGY STORAGE DEVICE APPLICATIONS”** submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for awarded of the degree of Master of Science in Physics is a record of original project M.Monisha (Reg.No:2021MSCP14) under the guidance of Dr. M. Ragam, Assistant Professor, Research Center of Physics, Fatima College, Madurai.

M. Monisha

**OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH ZINC OXIDE AND  
CALCIUM OXIDE FOR WHITE LIGHT EMISSION**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**PAPINA P (Reg.No.2021MSCP16)**

External Guide & Internal Guide

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**(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)**

Mary Land

MADURAI – 625 018

April 2023

## CERTIFICATE

This is to certify that the project work entitled “OPTICAL STUDIES ON BORATE GLASSES MODIFIED WITH ZINC OXIDE AND CALCIUM OXIDE FOR WHITE LIGHT EMISSION” submitted by PAPINA P (Reg.No.2021MSCP16) under the guidance of **Dr. Ancemma Joseph**, Assistant Professor, Research centre of Physics, Fatima College, Madurai. This work has been completed successfully towards the partial fulfillment of requirements for the award of the Degree of Master of Science in Physics DURING THE ACADEMIC YEAR 2021-2023.



(Dr.A.SheelaVimala Rani),

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Fatima College,

Madurai.



(Dr.Ancemma Joseph),

Assistant Professor,

Research Centre of Physics,

Fatima College,

Madurai.

## DECLARATION

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I express my sincere thanks to my friends and my classmates for their moral support encouragement for my project work.

**I sincerely acknowledge project fund received under DST CURIE core Grant for Women PG colleges DST/CURIE-PG/2022/11**

*P. Papina*  
(PAPINA.P)

**SYNTHESIS AND CHARACTERIZATION OF  
TITANIUMDIOXIDE/REDUCED GRAPHENE OXIDE  
(TiO<sub>2</sub>/rGO) USING SOL - GEL TECHNIQUE.**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To Partial Fulfillment of requirements for the award of the degree of

**MASTER OF SCIENCE IN PHYSICS**

**Submitted by**

**POORNIMADEVI .B ( Reg . No: 2021MSCP17)**

**External Guide**

**Dr. R. Selvarajan M. Tech PhD Teaching Fellow**

Centre for Nano Science and Technology, A.C.Tech Campus, Anna University

**Internal Guide**

**Dr .A .Sheela Vimala Rani**

Head & Associate Professor, Research center of physics, Fatima College, Madurai



**FATIMA COLLEGE (AUTONOMOUS)**

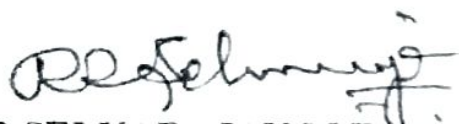
**RE-ACCREDITED WITH 'A++' GRADE BY NAAC (cycle 4)**

Mary Land, Madurai -625 018.

April 2023

## **BONAFIDE CERTIFICATE**

This is to certify that the work continued in the thesis entitled "**SYNTHESIS AND CHARACTERIZATION OF TITANIUM DIOXIDE / REDUCED GRAPHENE OXIDE (TiO<sub>2</sub>/rGO) NANOCOMPOSITE BY SOL-GEL METHOD**" is submitted to Fatima College, Madurai in fulfilment for the award of the degree of Master of Science in Physics. This is the record of original Project work done by **Ms. POORNIMADEVI. B – 2021MSCP17, II-M.Sc Physics at the Centre for Nanoscience and Technology, Anna University, Chennai-600025** Under the guidance of **Dr R.SELVARAJAN M.Tech., Ph.D, Centre for Nanoscience and Technology, A.C.Tech Campus, Anna University, Chennai-600 025** and **Dr. A. SHEELA VIMALA RANI, Associate Professor and Head, Research Centre of Physics, Fatima College, Madurai during December 2022 –January 2023.**



**Dr R.SELVARAJAN M.Tech., Ph.D**

Teaching Fellow,  
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Anna University, Chennai-600 025.



**Dr. A. SHEELA VIMALA RANI**

Associate Professor and Head,  
Research Centre of Physics,  
Fatima College(autonomous),  
Madurai -625018.

## DECLARATION

---

I hereby declare that the project work in this thesis entitled **“SYNTHESIS AND CHARACTERIZATION OF TITANIUMDIOXIDE/REDUCED GRAPHENE OXIDE ( $\text{TiO}_2/\text{rGO}$ ) USING SOL-GEL TECHNIQUE”** submitted to Fatima College in partial fulfillment of the requirements for the award of the degree **“Master of Science in Physics”**, is the record of original Project work done by me for under the guidance of Dr. A. Sheela Vimala Rani, Head and Associate Professor, Research Centre of Physics, Fatima College, Madurai. and Dr. R. Selvarajan, (Nano Science and Technology), M. Tech PhD, Teaching Fellow, Centre for Nano science and Technology, AC Tech Campus, Anna University, Chennai. It has not been submitted for the award of any Degree/Diploma in Madurai Kamaraj University or any other university/institutions.

*Poornimadevi B*

**B.POORNIMADEVI**

**(2021MSCP17)**

**Place:** *Madurai*

**Date:** *05.04.2023*

## ACKNOWLEDGEMENT

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### “GLORY TO GOD ALMIGHTY WHO GIVES US THE VICTORY”

We are grateful to **Dr.Sr.G.CELINE SAHAYA MARY**, Principal, Fatima College, Madurai, for permitting us to carry out our project at Anna University, Chennai. and also, I would like to thank **Dr.Sr.M. FRANCISCA FLORA**, Secretary, Fatima College, Madurai for her prayers and blessings.

I wish to express my deep sense of gratitude and Sincere thanks to my guide **Dr .R. Selvarajan**, (Nano Science and Technology). Teaching Fellow, Centre for Nanoscience and Technology, AC Tech Campus, Anna University, Chennai, for his constant support, valuable advice, inspiration, encouragement and for extending the laboratory facilities to complete the Project work. I considered myself extremely fortunate to get an opportunity to work under him.

I am grateful to **Dr.A.SHEELA VIMALA RANI**, Head, Research Centre of Physics, Fatima College, Madurai, for her valuable suggestions throughout my project work and for her constant support and encouragement in the successful completion of this project work.

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DST/CURIE-PG/2022/11

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Finally, I take this opportunity to express my lovable and heartfelt thanks to my beloved parents Mr. P.BHARATHI and Mrs. B.ANGULAKSHMI for their constant support and encouragement to me during this project

  
(B.POORNIMADEVI)

**FABRICATION OF PROTON CONDUCTING BATTERY  
WITH BIOMATERIAL MEMBRANE AS  
ELECTROLYTE BASED ON AZADIRACHTA INDICA  
(NEEM LEAF) AND AMMONIUM FORMATE**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY, Madurai**)

To partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**Ms. V. PREMA (REG.NO:2021MSCP18)**

**EXTERNAL GUIDE:**

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Director,

Materials Research Center,

Coimbatore

& Emeritus Professor,

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Coimbatore.

**INTERNAL GUIDE:**

**Dr. I. JEYA SHEELA**

Assistant Professor,

Research Centre of Physics,

Fatima College,

Madurai.



**RESEARCH CENTRE OF PHYSICS**

**FATIMA COLLEGE (AUTONOMOUS)**

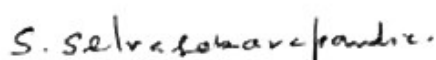
(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)

**MARY LAND, MADURAI-625018**

**APRIL 2023**

## BONAFIDE CERTIFICATE

This is to certify that the project report entitled "FABRICATION OF PROTON CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND AMMONIUM FORMATE" submitted to Fatima College, Madurai in partial fulfilment for the award of the degree of MASTER OF SCIENCE IN PHYSICS. This is the record of original project work done by V.PREMA at Materials Research Center, Madurai under the guidance of Dr. S. SELVASEKARAPANDIAN, Director, Materials Research Center, Coimbatore and Emeritus Professor, Bharathiar University, Coimbatore and Dr. I. JEYA SHEELA, Assistant Professor, Research Centre of Physics, Fatima College, Madurai and submitted to Research Centre of Physics, Fatima College, Madurai.

  
Dr. S. Selvasekarapandian

Director,  
Materials Research Center,  
Coimbatore &  
Emeritus Professor,  
Bharathiar University,  
Coimbatore.

  
Dr. I. Jeya Sheela

Assistant Professor,  
Research Centre of Physics,  
Fatima College,  
Madurai.

  
Dr. A. Sheela Vimala Rani

Head & Associate professor,  
Research Centre of Physics,  
Fatima College,  
Madurai.

## DECLARATION

I do hereby declare that this dissertation entitled "FABRICATION OF PROTON CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA(NEEM LEAF) AND AMMONIUM FORMATE" has been carried out by V.PREMA (Reg.No:2021MSCP18) and submitted to Research Centre of Physics, Fatima College, Madurai in partial fulfilment of the requirements for the award of MASTER OF SCIENCE IN PHYSICS, during the academic year, 2021-2023.

V. Prema

**V.PREMA**

Reg.No:2021MSCP18

II M.Sc. PHYSICS,

FATIMA COLLEGE,

MARY LAND,

MADURAI-18

Place: Madurai

Date : 05.04.2023

## ACKNOWLEDGEMENT

**"GLORY TO GOD ALMIGHTY WHO GIVES US THE VICTORY"**

We are grateful to **Dr. Sr. G. CELINE SAHAYA MARY**, Principal, Fatima College, Madurai for permitting us to carry out our project at Materials Research Center, Madurai and also, I would like to thank **Dr. Sr. M. FRANCISCA FLORA**, Secretary, Fatima College, Madurai for her prayers and blessings.

I thank **Dr. A. SHEELA VIMALA RANI**, Head and Associate professor, Research Centre of Physics, Fatima College, Madurai for her constant support and encouragement in the successful completion of this project work.

I am greatly indebted to **Dr. S. SELVASEKARAPANDIAN**, Director, Materials Research Center, Coimbatore & Emeritus Professor, Bharathiar University, Coimbatore for his constant support and supervision throughout the project work and for initiating my interest in research. I owe a lot to him and express my deep sense of gratitude to him. I considered myself extremely fortunate to get an opportunity to work under him.

My indebted thanks to **Dr. I. JEYA SHEELA** Assistant Professor, Research Centre of Physics, Fatima College, for her constructive and sustained interest towards each and every stage of this work and her valuable suggestions throughout my project work.

We acknowledge project fund received under **DST CURIE** core Grant for Women PG Colleges **DST/CURIE-PG/2022/11**.

I thank **S. AAFRIN HAZAANA**, **N.MUNIRAJ@VIGNESH**, **R. MEERA NAACHIYAR**, **M. KANIAJAY BABU** & **P. MOHANAA MUTHUSELVI**, Research Scholars, Materials Research Center, Madurai for their constant support throughout this project work.

I thank my beloved Mother **Mrs. V.THULASILAKSHMI** for her motivation and support during this project. I thank my Father **Mr. S.VELUMANI**, for giving me strength to chase my dreams. He will always be in my heart because in there he is still alive. And also I would like to thank my friends for their valuable support.

*Y. Prema*  
(PREMA.V)

# **SYNTHESIS AND CHARACTERISATION OF MANGANESE DIOXIDE /REDUCED GRAPHENE OXIDE(MnO<sub>2</sub>-rGO) USING CHEMICAL PRECIPITATION TECHNIQUE**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To Partial Fulfillment of requirements for the award of the degree of

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**PRINCY.J ( Reg . No: 2021MSCP19)**

External Guide

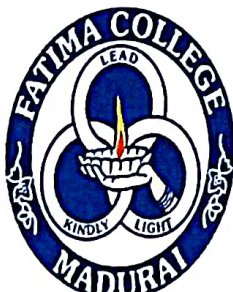
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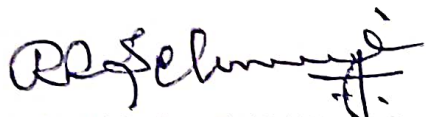
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RE-ACCREDITED WITH 'A++' GRADE BY NAAC (cycle 4)

Mary Land, Madurai -625 018.  
April 2023

## **BONAFIDE CERTIFICATE**

This is to certify that the work continued in the thesis entitled “ **SYNTHESIS AND CHARACTERIZATION OF MANGANESE DIOXIDE / REDUCED GRAPHENE OXIDE (MnO<sub>2</sub>/rGO) NANOCOMPOSITE BY CHEMICAL PRECIPITATION APPROACH** ” is submitted to Fatima College, Madurai in fulfilment for the award of the degree of Master of Science in Physics. This is the record of original Project work done by **Ms. PRINCY. J, 2021MSCP19, II-MSc Physics** at the **Centre for Nanoscience and Technology, Anna University, Chennai-600025** under the guidance of **Dr R.SELVARAJAN M.Tech., Ph.D., Centre for Nanoscience and Technology , A.C.Tech Campus , Anna University, Chennai-600 025** and **Dr. A. SHEELA VIMALA RANI, Associate Professor and Head, Research Centre of Physics, Fatima College, Madurai** during December 2022 –January 2023.



**Dr R.SELVARAJAN M.Tech., Ph.D**

Teaching Fellow,  
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## ACKNOWLEDGEMENT

### “GLORY TO GOD ALMIGHTY WHO GIVES US THE VICTORY”

We are grateful to **Dr.Sr.G.CELINE SAHAYA MARY**, Principal, Fatima College, Madurai, for permitting us to carry out our project at Anna University, Chennai, and also, I would like to thank **Dr.Sr.M. FRANCISCA FLORA**, Secretary, Fatima College, Madurai for her prayers and blessings.

I wish to express my deep sense of gratitude and Sincere thanks to my guide **Dr .R.Selvarajan**, (Nano Science and Technology), Teaching Fellow, Centre for Nanoscience and Technology, AC Tech Campus, Anna University, Chennai, for his constant support, valuable advice, inspiration, encouragement and for extending the laboratory facilities to complete this work and supervision throughout the Project work. I considered myself extremely fortunate to get an opportunity to work under him.

I am grateful to **Dr.A.SHEELA VIMALA RANI**, Head, Research Centre of Physics, Fatima College, Madurai, for her valuable suggestions throughout my project work and for her constant support and encouragement in the successful completion of this project work. We acknowledge project fund received under DST CURIE core Grant for Women Colleges DST/CURIE-PG/2022/11

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Finally, I take this opportunity to express my lovable and heartfelt thanks to my beloved parents **Mr. R.JOHN PETER** and **Mrs. J.AROKIA MARY**. for their constant support and encouragement to me during this project

*J.Princy*  
(J.PRINCY)

## DECLARATION

I hereby declare that the project work in this thesis entitled "SYNTHESIS AND CHARACTERIZATION OF MANGANESE DIOXIDE/REDUCED GRAPHENE OXIDE (ZnO/rGO) USING CHEMICAL PRECIPITATION TECHNIQUE" submitted to Fatima College in partial fulfillment of the requirements for the award of the degree "Master of Science in Physics", is the record of original Project work done by me for under the guidance of Dr.A.Sheela Vimala Rani, Head and Associate Professor, Research Centre of Physics, Fatima College, Madurai. and Dr. R. Selvarajan, (Nano Science and Technology). M. Tech PhD, Teaching Fellow, Centre for Nano science and Technology, AC Tech Campus, Anna University, Chennai. It has not been submitted for the award of any Degree/Diploma in Madurai Kamaraj University or any other university/institutions.

Place: Madurai .

J. Princy  
PRINCY.J

Date: 5 . 4 . 20 23

(2021MSCP19)

# **INVESTIGATIONS ON BFO-BTO NANOCOMPOSITES FOR BIO-SENSOR APPLICATIONS**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfilment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

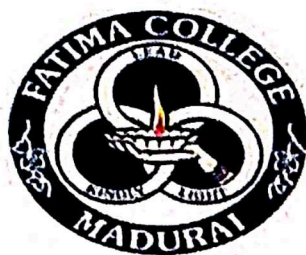
**SHINEY PRECILLA S (Reg.No.2021MSCP20)**

External Guide & Internal Guide

**Dr. M. RAGAM, M.Sc., M.Phil., Ph.D.**

Assistant Professor, Research Centre of Physics,

Fatima College, Madurai.



**FATIMA COLLEGE (AUTONOMOUS)**

(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)

Mary Land

MADURAI – 625 018

April 2023

## CERTIFICATE

This is to certify that the project work entitled “INVESTIGATIONS ON BFO-BTO NANOCOMPOSITES FOR BIO-SENSOR APPLICATIONS” submitted by SHINEY PRECILLA S (Règ.No.2021MSCP20) under the guidance of Dr.M.RAGAM, Assistant Professor, Research centre of Physics, Fatima College, Madurai. This work has been completed successfully towards the partial fulfilment of requirements for the award of the Degree of Master of Science in Physics DURING THE ACADEMIC YEAR 2021-2023.



(Dr.A.SheelaVimala Rani),  
Head, Research Centre of Physics,  
Fatima College,  
Madurai.



(Dr.M.Ragam),  
Assistant Professor,  
Fatima College,  
Madurai.

## DECLARATION

I hereby declare that the dissertation titled **“INVESTIGATIONS ON BFO-BTO NANOCOMPOSITES FOR BIO-SENSOR APPLICATIONS”** submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for awarded of the degree of Master of Science in Physics is a record of original project SHINEY PRECILLA S (Reg No:2021MSCP20) under the guidance of Dr. M. RAGAM, Assitant Professor, Research Center of Physics, Fatima College, Madurai.

Shiney Precilla S.

# **SYNTHESIS AND CHARACTERIZATION OF COPPER OXIDE/REDUCED GRAPHENE OXIDE (CuO/rGO) USING CHEMICAL PRECIPITATION TECHNIQUE.**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To Partial Fulfillment of requirements for the award of the degree of

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**SIVAPRIYADHARSHINI. R ( Reg. No: 2021MSCP21)**

External Guide

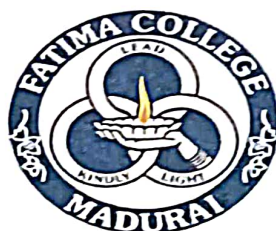
**Dr. R. Selvarajan M. Tech Ph.D Teaching Fellow**

Centre for Nano Science and Technology, A.C.Tech Campus, Anna University

Internal Guide

**Dr .A .Sheela Vimala Rani**

Head & Associate Professor, Research center of physics, Fatima College, Madurai



**FATIMA COLLEGE (AUTONOMOUS)**

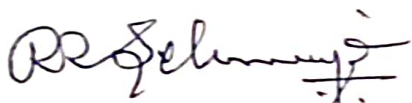
RE-ACCREDITED WITH 'A++' GRADE BY NAAC (cycle 4)

Mary Land, Madurai -625 018.

April 2023

## BONAFIDE CERTIFICATE

This is to certify that the work continued in the thesis entitled "SYNTHESIS AND CHARACTERIZATION OF COPPER OXIDE / REDUCED GRAPHENE OXIDE (CuO /rGO) NANOCOMPOSITE BY CHEMICAL PRECIPITATION APPROACH" is submitted to Fatima College, Madurai in fulfilment for the award of the degree of Master of Science in Physics. This is the record of original Project work done by Ms. SIVAPRIYADHARSHINI. R, 2021MSCP21, II-MSc Physics at Centre for Nanoscience and Technology, Anna University, Chennai-600025 under the guidance of Dr R.SELVARAJAN M.Tech., Ph.D Centre for Nanoscience and Technology , A.C.Tech Campus , Anna University, Chennai-600 025 and Dr. A. SHEELA VIMALA RANI, Associate Professor and Head, Research Centre of Physics, Fatima College, Madurai during December 2022 –January 2023.




Dr R.SELVARAJAN M.Tech., Ph.D

Teaching Fellow,

Centre for Nanoscience and Technology,

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Anna University, Chennai-600 025.



Dr. A. SHEELA VIMALA RANI

Associate Professor and Head,

Research Centre of Physics,

Fatima College(autonomous),

Madurai-625018.

## DECLARATION

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Place: *Madurai*

Date: *05-04-2023*

*R. Sivapriyadharsini*

R. SIVAPRIYADHARSHINI

(2021MSCP21)

## ACKNOWLEDGEMENT

---

**“GLORY TO GOD ALMIGHTY WHO GIVES US THE VICTORY”**

We are grateful to **Dr.Sr.G.CELINE SAHAYA MARY**, Principal, Fatima College, Madurai, for permitting us to carry out our project at Anna University, Chennai, and also, I would like to thank **Dr.Sr.M. FRANCISCA FLORA**, Secretary, Fatima College, Madurai for her prayers and blessings.

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*R. Sivapriyadharshini*  
(R. SIVAPRIYADHARSHINI)

**SYNTHESIS AND CHARACTERIZATION OF Co/Fe - MgO/CNT BIMETALLIC  
COMPOSITE FOR SUPERCAPACITOR APPLICATION**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

In partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**SUNDARI B (Reg.No.2021MSCP25)**

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Internal Guide

**Dr. I. JANET SHERLY, M.Sc., M.Phil., Ph.D.**

Assistant Professor, Research Centre of Physics, Fatima College, Madurai.



**FATIMA COLLEGE (AUTONOMOUS)**

(RE-ACCREDITED WITH 'A++' BY NAAC)

Mary Land ,

MADURAI – 625 018.

April 2023

## CERTIFICATE

This is to certify that the project work entitled “SYNTHESIS OF Co-Fe - MgO/CNT BIMETALLIC COMPOSITE FOR SUPERCAPACITOR APPLICATIONS” submitted by SUNDARI B (Reg.No:2021MSCP25) under the guidance of Dr. R. YUVAKKUMAR, Assistant Professor, Alagappa University, Science Campus, Karaikudi is submitted to Department of Physics, Fatima College. This work has been completed successfully towards in partial fulfilment of requirements for the award of the Degree of Master of Science in Physics DURING THE ACADEMIC YEAR 2021-2023.



**Dr.R.YUVAKKUMAR**

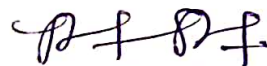
Assistant Professor,

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Alagappa University,

Science Campus,

Karaikudi.



**Dr. I. JANET SHERLY**

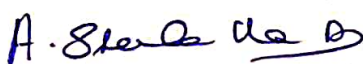
(Internal Guide)

Assistant Professor,

Research Centre of Physics,

Fatima College,

Madurai.



**Dr.A.SHEELA VIMALA RANI**

Head & Associate Professor,

Research Centre of Physics,

Fatima College,


Madurai.

## DECLARATION

I hereby declare that the dissertation titled **“SYNTHESIS AND CHARACTERIZATION OF Co/Fe - MgO/CNT BIMETALLIC COMPOSITE FOR SUPERCAPACITOR APPLICATIONS** submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for the award of the degree of Master of Science in Physics is a record of original project done by SUNDARI B (Reg No:2021MSCP25) under the guidance of Dr. I .JANET SHERLY, Assitant Professor, Research Center of Physics, Fatima College, Madurai and Dr.R.YUVAKKUMAR,Assistant Professor, Alagappa University,Science Campus, Karaikudi.It has not been submitted for the award of any Degree/Diploma in Madurai Kamaraj University or any other university/institutions.

Place: MADURAI

Date: 05 . 04 . 2023

  
B.SUNDARI

(2021MSCP25)

## ACKNOWLEDGEMENT

This academic pursuit drew inspiration from many sources. It is present Privilege to place my sincere gratitude to one and all who inspired and helped in this endeavor on the report. At the outset, I submit by heartfelt sincere, humble gratitude to the GOD ALMIGHTY, who has given strength for the successful completion of my course.

I wish to express my profound gratitude to DR. Sr. G. CELINE SAHAYA MARY, Principal, Fatima College, for permitting me to do the project work at PG level.

I convey my heartfelt thanks to Dr. I. JANET SHERLY, Assistant Professor, Research centre of Physics, Fatima College, Madurai for her excellent guidance constant encouragement, valuable ideas and deep concern to help to all along my project work.

I am greatly indebted to Dr. R. YUVAKKUMAR , Assistant Professor, Department of Physics, Alagappa University, Science Campus, Karaikudi, for his constant support and supervision throughout the internship work and for initiating my interest in research. I owe a lot to him and express my deep sense of gratitude to him. I considered myself extremely fortunate to get an opportunity to work under him.

I express my deep sense of gratitude to DR. A. SHEELA VIMALA RANI, Head, Research Centre Of Physics for her wise counsel, sincere and valuable suggestion throughout my project work.

I feel happy indebted to all faculty Member of Department of Physics, Fatima college, who provided their support, inspiration and suggestion to prepare this report.

We acknowledge project fund received under DST CURIE core Grant for Women PG Colleges DST/CURIE-PG/2022/11.

I offer most sincere and humble gratitude to my beloved Parents who vested keen interest and kind encouragement in the progress and helped us financially.

I express my sincere thanks to my friends and my classmates for their moral support encouragement for my project work.

  
(B.SUNDARI)

**FABRICATION OF ZINC- ION CONDUCTING BATTERY  
WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE  
AZADIRACHTA INDICA (NEEM LEAF) AND ZINC  
CHLORIDE**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfilment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**S. ANGELIN SNEGA**

**(Register No: 2021MSCP26)**

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**Dr. S. SELVASEKARAPANDIAN**

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**INTERNAL GUIDE**

**Dr. I. JEYA SHEELA**

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Madurai.



**RESEARCH CENTRE OF PHYSICS  
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MARY LAND, MADURAI-625018**

**APRIL 2023**

## BONAFIDE CERTIFICATE

This is to certify that the project report entitled “FABRICATION OF ZINC- ION CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND ZINC CHLORIDE” submitted to Fatima College, Madurai in partial fulfilment for the award of the degree of MASTER OF SCIENCE IN PHYSICS. This is the record of original project work done by S. ANGELIN SNEGA at Materials Research Center, Madurai under the guidance of Dr. S. SELVASEKARAPANDIAN, Director, Materials Research Center, Coimbatore and Emeritus Professor, Bharathiar University, Coimbatore and Dr. I. JEYA SHEELA, Assistant Professor, Research Centre of Physics, Fatima College, Madurai and submitted to Research Centre of Physics, Fatima College, Madurai.

  
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Dr. I. JEYA SHEELA

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Dr. A. SHEELA VIMALA RANI

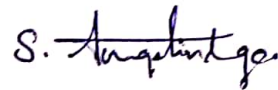
Head & Associate professor,  
Research Centre of Physics,  
Fatima College,  
Madurai.

## DECLARATION

I do hereby declare that this dissertation entitled “**FABRICATION OF ZINC - ION CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND ZINC CHLORIDE**” has been carried out by **S. ANGELIN SNEGA** (Reg.No:2021MSCP26) and submitted to Research Centre of Physics, Fatima College, Madurai in a partial fulfilment of the requirements for the award of **MASTER OF SCIENCE IN PHYSICS**, during the academic year, 2021 – 2023.

Place: Madurai

Date: 05.04.2023



**S. ANGELIN SNEGA**

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II M.Sc .PHYSICS,

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## ACKNOWLEDGEMENT

### “GLORY TO GOD ALMIGHTY WHO GIVES US THE VICTORY”

We are grateful to **Dr. Sr. G. CELINE SAHAYA MARY**, Principal, Fatima College, Madurai for permitting us to carry out our project at Materials Research Center, Madurai and also, I would like to thank **Dr. Sr. M. FRANCISCA FLORA**, Secretary, Fatima College, Madurai for her prayers and blessings.

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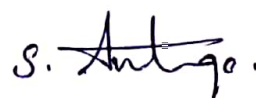
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I thank. **MEERA NAACHIYAR, S. AAFRIN HAZAANA, N. MUNIRAJ@VIGNESH, M. KANI AJAY BABU, P. MOHANAA MUTHUSELVI & T. SABEETHA**, Research Scholars, Materials Research Center, Madurai for their constant support throughout this project work.

I thank my beloved Mother **Mrs. S. REMILA RACHEL** for her motivation and support during this project. I thank my Father **Mr. T. SELVARAJ** for giving me strength to chase my dreams.



(S. ANGELIN SNEGA)

**SYNTHESIS AND CHARACTERIZATION OF FMO, FMO-C,  
FMO-rGO COMPOSITE IN WATERSPLITTING APPLICATION**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

In partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**SIVAPRIYA.M (Reg.No.2021MSCP27)**

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**(RE-ACCREDITED WITH 'A++' BY NAAC)**

Mary Land, Madurai – 625 018.

April 2023

## CERTIFICATE

This is to certify that the project work entitled “**SYNTHESIS OF FMO, FMO-C, FMO-rGO COMPOSITE IN WATER SPLITTING APPLICATIONS**” submitted by **SIVAPRIYA.M** (Reg.No:2021MSCP27) under the guidance of **Dr. R. YUVAKKUMAR**, Assistant Professor, Alagappa University, Science Campus, Karaikudi is submitted to Department of Physics, Fatima College. This work has been completed successfully towards the partial fulfilment of requirements for the award of the Degree of Master of Science in Physics during the academic year 2021-2023.



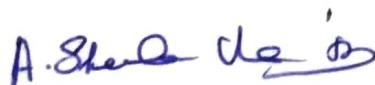
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**Dr. A. SHEELA VIMALA RANI**

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## DECLARATION

I hereby declare that the dissertation titled “**SYNTHESIS OF FMO, FMO-C, FMO-rGO COMPOSITE IN WATERSPLITTING**” submitted to Fatima College (affiliated to Madurai Kamaraj University), Madurai for the awarded of the degree of Master of Science in Physics is a record of original project done by **SIVAPRIYA.M (Reg No:2021MSCP27)** under the guidance of Dr. I.JANET SHERLY, Assitant Professor, Research Center of Physics, Fatima College, Madurai.

Place: Madurai

Date: 05 - 04 - 2023



**SIVAPRIYA.M**

(2021MSCP27)

# **FABRICATION OF LITHIUM-ION CONDUCTING BATTERY WITH BIOMATERIAL MEMBRANE AS ELECTROLYTE BASED ON AZADIRACHTA INDICA (NEEM LEAF) AND LITHIUM CHLORIDE**

A dissertation submitted to

**FATIMA COLLEGE (AUTONOMOUS)**

(Affiliated to **MADURAI KAMARAJ UNIVERSITY**, Madurai)

To partial fulfillment of the requirements for the award of the degree

**MASTER OF SCIENCE IN PHYSICS**

Submitted by

**Ms. A. ABINAYA (REG.NO: 2021MSCP28)**

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**(RE-ACCREDITED WITH 'A++' GRADE BY NAAC)**

**MARY LAND, MADURAI-625018**

**APRIL 2023**

## BONAFIDE CERTIFICATE

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Dr. A. SHEELA VIMALA RANI

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Place: Madurai

Date : 05 / 04 / 2023



**A. ABINAYA**

Reg.No:2021MSCP28

II M.Sc. PHYSICS,

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## ACKNOWLEDGEMENT

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*A. Abinaya*  
(ABINAYA.A)