Bharath
INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Declared as Deemed-to-be University under section 3 of UGC Act, 1956)
(Vide Notification No. F.9-5/2000 - U.3, Ministry of Human Resource Development, Govt. of India, dated 4th July 2002)
Accredited by NAAC
Phone : 044-22290742 / 22290125 . Telefax : 044-22293886
Website : www.bharathuniv.ac.in
173, Agaram Road, Selaiyur, Tambaram,
Chennai - 600 073. Tamil Nadu.

Ref No.SMS-2018-O-28

Date: 07/11/2019

TO

Mr. Dr. S. Lakshmanan,

Associate Professor/ Chemistry,

BIHER.

BHARATH INSTITUTE OF HIGHER EDUCATION & RESEARCH (Declared as Deemed to be University U/S 3 of UGC Act 1956) 07 NOV 2019 OFFICE OF THE DEAN-RESEARCH Selaiyur, Chennai-600 073. INDIA

Thro: Concern Head of the Department

Greetings!!!

We are happy to announce that the Research Advisory Committee has approved your proposal for Seed Money Scheme-2018 which was presented by you. You are requested to complete the proposal and send the progress report to the Dean Research in the prescribed time period.

Title of the Project: Design, Synthesis, Sensor Study and Biological Evolution of Heterocyclic Compounds.

Seed Money Amount: Rs.1, 00,000/- (Rupees One Lakh Only)

Approved on: 04/11/2019

Payment details:

Voucher No.28

Dated: 08/11/2019

With Regards

07/11/2019

Dean-Research

Bharath University

SELAIYUR, CHENNAI - 600 073, TAMIL NADU, INDIA.

CASH / PAYMENT VOUCHER

Date 08/11/19

V.No. : 028.

Debit _____ Amount

Rs. 1,00,000/-

PAID TO Mr. S Lakshmanan.

RUPEES one Lakh only.

TOWARDS Seed Money scheme - 2018.

BHARATH UNIVERSITY CHENNAI 600 073 INDIA

Authorised by **Finance Manager** **Cashier/Accountant** **Payee's Signature**

FORMAT FOR PROPOSAL SUBMISSION

1. Details of Principal Investigator

Name	:	Dr. S. LAKSHMANAN
Designation	:	Associate professor
Highest Qualifications	:	Ph.D.,
Department	:	Chemistry
E-mail	:	lachuchem666@gmail.com
Contact no	:	+91-9843632843
Date of Joining	:	29/07/2019

2. Details of Co-Principal Investigator

Name	:	Dr. K. Rajendran
Designation	:	Associate Professor
Highest Qualifications	:	Ph.D.,
Department	:	Chemistry
E-mail	:	rajendran1317@gmail.com
Contact no	:	+91-7397264554
Date of Joining	:	17/18/2015

Technical details

1. Introduction

The science of organic chemistry got developed because of large scale pharmaceutical, polymer, food and other energy providing bio-molecules and other applications. The new developments in the form of genetic engineering and molecular biology have contributed extensively towards understanding of life or better life for human beings. However, at the end of 20th century scientist have realized that for sustainable life, we have to arrest the population growth and make this earth green. Hence, the environmental science issues are being tackled and getting importance, such as Heterocyclic is a promising structural moiety for drug design like Nitrogen, oxygen ,etc containing heterocyclic derivatives form a component in a number of useful drugs and are associated with many biological and therapeutical activities. The challenging task of achieving 'efficiency' in all aspects of chemical production, advocated by green chemistry can be realized by innovative research which comprehensively addresses the issues of atom economy, economy of steps and avoidance of auxiliary chemicals. Developing a simple, eco-friendly reaction protocol for the synthesis of compound libraries of medicinal scaffolds is as an attractive area of research.

Much attention has been focused on chemosensors for the detection of chemically and is biologically important ions. In this context, the design of easy-to-make and "switch on"- type fluorescent sensors based on host–guest interaction is still a synthetic challenge and it would be desirable not only in the field of analytical chemistry but also in biomedical and environmental research because highly sensitive assay systems might then be feasible.

Electro analytical method have a long history of development of ion selective electrode or sensors based on the faradaic electro chemistry, electronic, ionic and mixed conductors. sensors

contains covalently attached functionalized group sometimes membranes. These membranes include sulfonated pol(tetra fluoro ethylene) with SO3- sites and plasticized, functionlized, poly vinyl chloride with COO ,SO3 ,(P=O),(OH2)O and +NR3 sites. These membranes have general potentiometric response for many cations and are useful as general ion sensors.

Keywords: 1.Novel synthesis, 2.Electrochemical analysis, 3.fluorescence Emission, 4.Biological.

2. Review of status of Research and Development in the subject

The present research manuscript reports a basic study of the condensation reaction, have some similarity to the Biginelli[9]Hantzsch Knoevenagel reactions; as each one of these employs aldehyde, acetoacetic ester (active methylene compound). The earliest of these seems to be the discovery of the Hantzsch reaction which was reported in 1881. Where in Hantzsch heated acetoacetic ester, an ammonia source, and an aldehyde, to obtain the now well-known dihydropyridines or Hantzsch pyridines. A decade later the Italian chemist P. Biginelli in 1893 reacted same two components in equimolar ratio viz. acetoacetic ester, aldehyde and third component as urea in acidic alcoholic solution to obtain a new compound, the now well-known3,4-dihydropyrimidin-2(1H)-ones or Biginelli compounds .

Designing and synthesizing highly sensitive and selective chemo sensors for heavy metal ions have become increasingly important because of their close relationship with environmental, industrial, biological and human health. ,Chemosensors based on ion-induced changes in fluorescence appear to be particularly attractive due to their simplicity, high sensitivity and high selectivity response,Therefore the detection of different metal ions such as Hg2+, Pb,2+, Ni2+, Cd2+, etc..,cations or neutral molecules13,14based on photo induced electron transfer (PET) have been reported. However, novel chemosensors are required to achieve the goal of extensively recognizing other heavy metal ions. It is also known that the disturbance of metabolism is closely

associated with severe neurological disease, including Alzheimer's disease(AD) prostate cancercerebral ischemia and epilepsy. In recent years the development of fluorescent sensors for ions has become a very active area in the field of chemical biology.

2.1 International Status

Simple and green synthetic procedures constitute an important goal in organic synthesis. Multicomponent reactions (MCRs), defined as one-pot reactions in which at least three different substrates join through covalent bonds, have steadily gained importance in synthetic organic chemistry One-pot MCRs often shorten reaction periods, giving higher overall chemical yields than multiple-step syntheses, and therefore can reduce the use of energy and manpower. Green chemistry strongly influences chemical research, and there is an insistence on the use of 'greener' reaction conditions.(the industrial type of microwave oven used is Multi-component reaction (MCR) protocols in water will be one of the most suitable strategies, which will meet the requirements of green chemistry as well as for developing libraries of medicinal scaffolds. One key aspect of multicomponent reactions is that they are an important source of molecular diversity.18 For instance, a three component coupling reaction will provide 1000 compounds when 10 variants of each component are employed. This aspect together with its inherent simple experimental procedures and its one-pot character, make MCRs highly suitable for automated synthesis. They are powerful tools in modern drug discovery processes allowing rapid, automated and high throughput generation of organic compounds.

Literature survey reveals that number of octahydroquinazolinone derivatives have been synthesized by Biginelli reaction conditions Naphthoquinones and their derivatives occur in various families of plants, fungi, bacteria and insects, Many of these naturally occurring naphthoquinones and their synthetic analogues are important precursors for the synthesis of

natural products and pharmaceuticals. 2-Hydroxy-1,4-naphthoquinone (HNQ; Lawsone; CAS 83-72-7) is the principal natural dye ingredient contained in the leaves of Henna.

2.2 National Status

Literature survey reveals that number of octahydroquinazolinone derivatives have been synthesized by Biginelli reaction conditions Naphthoquinones and their derivatives occur in various families of plants, fungi, bacteria and insects, Many of these naturally occurring naphthoquinones and their synthetic analogues are important precursors for the synthesis of natural products and pharmaceuticals. 2-Hydroxy-1,4-naphthoquinone (HNQ; Lawsone; CAS 83-72-7) is the principal natural dye ingredient contained in the leaves of Henna.

2.3 Importance of the proposed project in the context of current status including scientific objective

The present work is proposed with a high aim of novel heterocyclic composites and its biological study and also sensing of metals by electrochemical, fluorometric techniques. The generality of this reaction was examined using several types of aldehydes. In all cases, the reactions gave the corresponding products in good to excellent yield. Fluorescent heterocyclic compounds are of interest in many disciplines as, e.g., emitters for electroluminescence devices, molecular probes for biochemical research in traditional textile and polymer fields fluorescent whitening agents, and photo-conducting materials [36]. Quinone derivatives have been reported as fluorescence compounds. On the other hand, molecules with the quinone structure constitute one of the most interesting classes of compounds in organic chemistry, due to their biological properties, electrochemical property and their industrial applications, and their potential as intermediates in the synthesis of heterocyclic composite, as part of our research aimed at developing new methods for organic transformations, of as a part of our ongoing research on

novel chemical entities with biological activities.

3. Progress/achievement so far,

This proposed project is visualize with the following objectives

- The methodology and the successful coating that will be obtained through this proposed project may be used extensively for the implantation in near future.
- The resultant novel composite and sensor methodology could be nationally as well as internationally patented.

4. Work Plan:

This proposed project is visualize with the following objectives

- To achieve synthesis of novel heterocyclic compound with promote a suitable catalyst treatment procedure is to be achieved by chemical method
- To achieve the synthetic method in green aspect and biological evolution
- To investigate the sensitivity and coatings with the aid of electrochemical and fluorescence spectrometric analytical techniques.
- Study the sensing property electrochemically by using cyclic voltammetry, fluorometric.

Characterization achieved by 1HNMR, 13CNMR, FT-IR, ESI-LC/MS, SEM, TEM, XRD, Cell LINE.

4.1 Methodology:

- The project is aimed to develop a novel synthesis and sensor method, mostly concern in green methodology .sensing of ions in different effluent from industries around Chennai. Hence, all the chemicals and materials used in this project are non-toxic and environmental friendly.
- The methodology and the successful coating that will be obtained through this proposed project may be used extensively for the implantation in near future.
- The resultant novel composite and sensor methodology could be nationally as well as internationally patented.

4.2 Time Schedule of activities giving milestones through BAR diagram.

S. NO	ACTIVITIES	1st 4 (month)		2nd 4 (month)		3 rd 4 (month)	
1	Literature survey						
2	Recruitment and Purchase of chemicals						
3	Design synthesis of novel composite						
4	Sensor study						
	Characterization of composite						
5	Biological Studies						
6	Compilation of results, submission of papers & report preparation Efforts towards are commercialization of developed product						

4.3 Expected outcome within the time period of Seed Money Scheme

- The novel synthesis and sensor methodology that will be obtained through this proposed project may be potential for biological applications in near future.
- The resultant sensing methodology of this project could be nationally as well as internationally patented.
- The completed project work could be commercialized towards the large scale development of product.

- The results of our project work will be consolidated, published in highly reputed journals.
- A group of full time research scholars working under the guidance of PI will be highly benefited and will be trained to carry-out an independent research in this field.

5. Suggested Plan of action stating the name of funding agency where the project will be communicated for financial support within the time period of project.

NIL

6. Bibliography:

NIL

7. List of Projects submitted/implemented by the Investigators (Separate for Pi and Co-PI) :

NIL

7.1 Details of Projects submitted to various funding agencies:

Sl. No.	Title	Cost in lakhs	Month of submission	Role As PI/ Co-PI	Agency	Status
	NA	NA	NA	NA	NA	NA

7.2 Details of Projects under implementation

Sl. No.	Title	Cost in lakhs	Duration	Role As PI/ Co-PI	Agency
	NA	NA	NA	NA	NA

7.3 Details of Projects completed during the last 5 years

Sl. No.	Title	Cost in lakhs	Duration	Role as PI/ Co-PI	Agency
	NA	NA	NA	NA	NA

8. List of publications published by the Investigator

1. **Sivalingam Lakshmanan,** Narayanan Ramalakshmi, One-pot, four-component synthesis of benzylpyrazolyl naphthoquinone derivatives and molecular docking studies. ***Synthetic Communications,*** 2016, 46(24), 2045-2052.
2. **Sivalingam Lakshmanan,** Narayanan Ramalakshmi, S. Arul Antony, Synthesis, Quantum Chemical Studies and Cytotoxicity Activity of Diastereoselective trans-2,3-dihydronaphtho[2,3-b]furan Derivatives. ***Der Chemica Sinica,*** 2017, 8, 355-364.
3. **Sivalingam Lakshmanan,** Dharman Govindaraj, Narayanan Ramalakshmi, S. Arul Antony, Synthesis, Molecular docking, DFT calculations and Cytotoxicity activity of benzo[g]quinazoline derivatives in Choline Chloride-urea. ***Journal of Molecular Structure,*** 2017, 1150, 88 - 95.
4. J. Arul Hency Sheela, **Sivalingam Lakshmanan,** A. Manikandan, S. Arul Antony, Preparation and characterization of PVP-TiO2 NPs calcined at 500, 600 and 700oC by the hydrothermal method and their properties. ***Journal of Inorganic and Organometallic Polymers and Materials,*** 2018, 28, 2036-2045.
5. K. Thirumurugan, **Sivalingam Lakshmanan,** Dharman Govindaraj, D. Sam Daniel Prabu N. Ramalakshmi, S. Arul Antony, Design, synthesis and anti-inflammatory activity of pyrimidine scaffold benzamide derivatives as epidermal growth factor receptor tyrosine kinase inhibitors. ***Journal of Molecular Structure,*** 2018, 1171, 541-550.
6. J. Arul Hency Sheela, **Sivalingam Lakshmanan,** A. Manikandan, S. Arul Antony, Structural, morphological and optical properties of ZnO, ZnO:Ni^{2+} and ZnO:Co^{2+} nanostructures by hydrothermal process and their photocatalytic activity, ***Journal of Inorganic and Organometallic Polymers and Materials,*** 2018, 1-11.
7. G. Jaganathan, K. Manivannan, **S. Lakshmanan**, M. Aboobucker Sithique, Fabrication and characterization of Artocarpus heterophyllus waste derived lignin added chitosan biocomposites for wound dressing application, ***Sustainable Chemistry and Pharmacy,*** 2018 10, 27-32.
8. N. Nagamani, **Sivalingam Lakshmanan,** Dharman Govindaraj, Chinnadurai Ramamoorthy, Narayanan Ramalakshmi, S. Arul Antony, Selective And Efficient Detection Of Picric Acid Among Other Nitroaromatics By Nir Fluorescent Cyanine Chemosensors, ***Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy,*** *2019, 207, 321-327.*

9. D. Sam Daniel Prabu, **Sivalingam Lakshmanan,** K. Thirumurugan, N. Ramalakshmi, Dharman Govindaraj, S. Arul Antony, Synthesis, characterization of benzimidazole carboxamide derivatives as potent Anaplastic lymphoma kinase inhibitor and antioxidant activity, ***Synthetic communication***, *2018, 49(18), 266-278.*

10. C. Thirumurugan, P. Vadivel, A. Lalitha, **S. Lakshmanan**, Synthesis, characterization of novel quinoline-2- carboxamide based chalcone derivatives and their molecular docking, photochemical studies, ***Synthetic communication***, 2019, 14, 831-839.

List of publications published by the co-Investigator

1. Jyh-Chien Chen.;Kuppachari Rajendran.; Ya-Hui Chang.; Sheng-Wen Huang.; Yaw-Tern Chern. "Highly Transparent and Organo-soluble Polyimides Derived from 2,2'-Disubstituted-4,4'-Oxydianilines", Journal of Applied Polymer Science. 2011, 6, 3159 - 3170.
2. Jyh-Chien Chen.;Kuppachari Rajendran.; Sheng-Wen Huang.; Hui-Wen Chang. "Synthesis and Characterization of Aromatic Polyamides Derived from Various Derivatives of 4,4'-Oxydianilines", Journal of Polymer Research, 2011, 18, 1693 - 1703.
3. Raguramsingh Narendar.; Keereyadath Priya Dasan.;Kuppachari Rajendran. "Coir pith/nylon/epoxy hybrid composites and its thermal properties: Thermogravimetric analysis, Thermal ageing and Heat deflection temperature", Journal of vinyl and additiveTechnology, 2017, DOI: 10.1002/vnl.21594.

9. Budget*

Sl. No.	Head	Amount in INR
1	A) Borosil RMA Stirring Mantle, BLFHRMA250 B) AIE UV-C Chamber 33 WATTS UV-C (35 Liters Capacity) - DIGITAL	12,000/- 11,000/-
2	Consumables (Like ICs, application boards, chemicals, testing charges, tools, etc.)	60,000/-
3	Travel support for the purpose of research work.	6,000/-
4	Contingency	4,000/-
5	Others	7,000/-
	Total	1,00,000/-

10. Name of at least two subject experts from the Institute and one from the outside Institute with their contact details:

a) Dr. P. Magesan – Associate professor, Dept. Of chemistry, BIHER, Chennai-600073

b) Dr. S. Poovaragan, Assistant Professor, Chennai Institute of Technology, Chennai- 600 069.

CERTIFICATE FROM THE INVESTIGATOR

Project Title: **Design, Synthesis, Sensor Study and Biological Evolution of Heterocyclic Compounds**

It is certified that

1. I do hereby agree to submit a complete proposal for financial support to the external funding agency within the time period of SMS-2018
2. I undertake that spare time on equipment procured in the project will be made available to other users.
3. I agree to submit a certificate from Institutional Biosafety Committee, if the project involves the utilization of genetically engineered organisms. I also declare that while conducting experiments, the Biosafety Guidelines of Department of Biotechnology, Department of Health Research, GOI would be followed in to.
4. I agree to submit ethical clearance certificate from the concerned ethical committee, if the project involves field trails/experiments/exchange of specimens, human & animal materials etc.
5. I agree to abide by the terms and conditions of SMS-2018, BIHER,Chennai

S. Lakshmanan

Name and signature of

Principal Investigator

Dr. S. Lakshmanan

K. Rajendran

Name and signature of

Co-Principal Investigator

Dr. K. Rajendran

Date: 05/10/2019
Place: Chennai-73

Forwarded by Head of the Department

Signature of the Head

PROJECT EVALUATION FORMAT

Recommendation Sheet

Name of the Investigator	Dr. S. Lakshmanan
Name of the Co-Investigator	Dr. K. Rajendran
Name of the Department	Chemistry
Title of project	Design, Synthesis, Sensor Study and Biological Evolution of Heterocyclic Compounds
Recommendation of the evaluation committee	Recommended
Financial allocation recommended	Rs. 1,00,000/-

Sl. No.	Head	Amount in INR
1	A) Borosil RMA Stirring Mantle, BLFHRMA250 B) AIE UV-C Chamber 33 WATTS UV-C (35 Liters Capacity) - DIGITAL	12,000/- 11,000/-
2	Consumables (Like ICs, application boards, chemicals, testing charges, tools, etc.)	60,000/-
3	Travel support for the purpose of research work.	6,000/-
4	Contingency	4,000/-
5	Others	7,000/-
	Total	1,00,000/-

Name and Signature of the Research Advisory Committee members with date

(Dr. P. Naveenchandran)