



Anand Nagar, Krishnankoil - 626126, Srivilliputtur (via), Virudhunagar District, Tamilnadu.

APPLICATION FOR ADMISSION TO Ph.D. PROGRAMMES

Date of Application:13-11-2020

Department	BIOTECHNOLOGY	Application No.	202020002
Area of Research	BIONANOTECHNOLOGY	Research Mode	PART TIME

Name :LEKSHMI R BABU
Date of Birth / Age :13-11-1984 / 36 Years
Gender :FEMALE
Category :OBC
e-Mail ID :lekshmirbabu@gmail.com
Mobile :+919496973673



Father's/Husband's Name	VIVEK B	Father's/Husband's Occupation	SOFTWARE ENGINEER
Family Income	300000	Residential Type	URBAN
Birth Place	TRIVANDRUM	Mother Tongue	MALAYALAM
Religion	HINDU	Martial Status	MARRIED
Aadhaar No.	568057327591	PAN No.	AJAPL7079H
Physically Challenged	NO	Type of Disability	-
Address for Communication: VANJIPUZHA PADEETATHIL NADUVILAMURI, PADANILAM ALLEPPY ALLEPPY DISTRICT KERALA INDIA Pin-690529		Permenant Address: RADHAMANDIRAM TC 12/678 , LVMRA 125, KUNNUKUZHY , VANCHIYUR PO THIRUVANANTHAPURAM TRIVANDRUM DISTRICT KERALA INDIA Pin-690529	

Qualification						
Degree	Discipline	College/university	Year Passed	AVG/CGPA	Class	Mode
M TECH	BIOTECHNOLOGY	KALSALINGAM UNIVERSITY	2011	7.96	1ST CLASS	REGULAR
B TECH	BIOTECHNOLOGY AND BIOCHEMICAL ENGINEERING	UNIVERSITY OF KERALA	2007	6.98	1ST CLASS	REGULAR

Experience				
Organization	Designation	Experience From	Experience TO	Work Nature
SREE BUDDHA COLLEGE OF ENGINEERING	ASSISTANT PROFESSOR	2011-12-19	2020-11-13	TEACHING
SREE CHITRA THIRUNAL COLLEGE OF ENGINEERING	GUEST LECTURER	2007-10-08	2008-05-15	TEACHING

Payment Details				
Transaction ID	Reference	Date of transaction	Amount	Status
202020002_201210192435	VHD49546324501	10-12-2020	600	SUCCESS

Research Proposal

Bio- route mediated synthesis of silver nanoparticles- preparation, characterization, and applications to sustainable energy production

1. Introduction

In my research, I will study applications and characterization of silver nanoparticles. In order to achieve this objective, I will prepare the desired metal nanoparticles using leaf extracts which will be in turn having surface functional groups and it also will provides a renewable source of energy by integrating nanotechnology thus leading to sustainable development. I will also use electrochemical methods, such as UV Spectroscopy, SEM, TEM, FTIR, XRD , EDAX to evaluate their morphology, size, functional groups, atomic and molecular structure etc and to understand stability of nanofluid which leads to energy production

2. Background

Water being an essential part in human life, the amount of wastewater generated from different sectors has been rapidly increased. The wastewater has been directly exposed to environment. Even though the wastewater is being treated before its release it is still being capable of introducing hazards to environment. Thus intelligent use of wastewater has become mandatory. Rather than recycling wastewater it can be used as a source of energy. Integration of nanoparticle and its technology into wastewater treatment and energy production found to be an efficient method. Wastewater serves to act as a renewable source of energy and converting waste into energy brings out an efficient method of waste management

Nanomaterials may provide solutions to technological and environmental challenges in the areas of solar energy conversion, catalysis, medicine, and water treatment .Nanomaterials often show unique and considerably changed physical, chemical and biological properties compared to their macro-scaled counterparts .The noble metals, especially silver and gold, have attracted great attention due to their innumerable applications in various branches of science, namely catalysis, photonics, photography, chemical sensing, Surface Enhanced Raman Scattering (SERS), and most importantly, in the medicinal field as anti-microbial agents Colloidal silver is of particular interest because of its distinctive properties, such as good conductivity, chemical stability, catalytic and antibacterial activity. Silver nanoparticles have many important applications that include spectrally selective coating for solar energy absorption and intercalation material for electrical batteries, as optical receptors, polarizing filters, catalysts in chemical reaction, bio-labelling, and as antimicrobial agents. There has been an extraordinary

growth in nanoscience and technology in recent years, mainly due to both the development of new techniques to synthesize nanomaterials and the accessibility of tools for the classification and manipulation of nanoparticles. Production of nanoparticles requires understanding the fundamentals of nanoscale chemistry and physics, as well as the know-how to commercialize them. Broadly speaking, there are two approaches to nanoparticle production: top-down and bottom-up. The former makes a material decrease its size from large to nanoscale, whereas the latter produces nanomaterials by starting from the atomic level (Tavakoli *et.al*). Generally, metal nanoparticles can be prepared and stabilized by chemical, physical and biological methods; the chemical approach, such as chemical reduction, electrochemical techniques, photochemical reduction and pyrolysis and physical methods, such as Arc-discharge and physical vapor condensation (pvc) is used. Living organisms have huge potential for the production of nanoparticles/nanodevices of wide applications.

Nanofluids

Nanofluids are a new class of fluids engineered by adding nanoscale particles in low volumetric fractions to a base fluid in order to enhance or improve their mechanical, optical and thermal properties. The base fluid can be any liquid such as water, oil, ethylene glycol or conventional fluid mixtures. Important features of using nanofluid include: (i) Enhancement in thermal conductivity far beyond the level any theory could predict (ii). Strong temperature dependence

3. Preliminary Results

The first part of my proposed research is to prepare biological production of nanosilver

To prepare biological synthesis of silver nanoparticles, I used leaf extracts. Our group has previously shown that silver nanoparticles can be prepared from plant extracts.

My first objective, therefore, was to optimise the synthesised leaf extracts, and that the resulting stable nanofluid which possess antimicrobial activity and further turning the nanofluid to act as renewable energy source.

Biosynthesis of nanosilver and optimisation of synthesis conditions

The preparation of silver nanoparticles is carried out in two steps: First, preparation of plant extracts are carried out and secondly preparation of silver nitrate solution. This warm extract solution changed colour again after adding AgNO_3 solution. Color changes are possible because some of the Ag ions begin to be reduced due to the effects of heat and produces Ag^+ complex. This complex was responsible for changing color from brownish yellow to

grayish brown. The Ag nanoparticles synthesized in each extract solution was analysed using UV-Vis spectroscopy. This was done to determine the characteristics of the peak spectrum of the Ag nanoparticle wavelength prepared for each different AgNO₃ concentrations. The characteristics of Ag nanoparticles normally appear at a wavelength interval of 400–600 nm [26]. UV-Vis spectra of Ag nanoparticles synthesized evince the blue shift of the absorption band with increasing AgNO₃ concentration. This information shows that the Ag nanoparticles have formed in the extract, where the Ag⁺ has been reduced to Ag⁰.

Characterization of Ag Nanoparticles. Reduction of pure Ag⁺ ions was monitored by measuring the UV-Vis spectrum of the reaction medium after diluting a small aliquot of the sample into distilled water. +ve colour change in the reaction mixture was recorded through visual observation. UV-Vis spectral analysis was done by using UV-Vis spectrophotometer UV-1800 (Shimadzu) at the wavelength of 200– 800 nm. JEOL JEM-1400 Transmission Electron Microscope (TEM), operating at 120 V and an acceleration voltage of 15 kV, was used to analyze the morphology and size of Ag nanoparticles. For TEM measurements, extract samples containing Ag nanoparticles were dispersed on a copper grid and dried at room temperature. Nanoparticles are quite poly-dispersed and a layer of the organic material surrounding the synthesized Ag nanoparticles could explain the good dispersion of these nanoparticles in solution. Generally, the Ag nanoparticles synthesized using aqueous extracts are well dispersed although some of them were noted to be agglomerated. Notably, the majority of the particles in the TEM images are not in physical contact with each other but appeared separated by the organic layer. Therefore, TEM images clearly indicate the coating of Ag nanoparticles with an organic layer. +ve presence of several polyphenolic components including flavonoids and terpenoids facilitated the reduction of Ag ions and also stabilized the surface of the resultant Ag nanoparticles. +ve Ag ions quantity influenced the size of the particles. When AgNO₃ concentration is increased, an obvious change in the size distribution of nanospheres was observed

4. Proposed Research

My preliminary results show that metal nanoparticles can be prepared by plant extracts . Here, I propose my future research based on the above preliminary results.

Biological production of nanosilver

The fresh leaves of plants needs to be collected and washed with deionized water to remove dust and foreign articles. Proper drying and deionisation needs to be carried out and extract was taken and heating is provided at various temperatures for 15 minutes. After the boiling,

sample needs to be diluted in various proportions to check the optimised conditions optimizing its synthesis conditions. I will perform the characterisation techniques such as SEM, TEM, FTIR, XRD, EDAX etc and find the shape, size, functional groups, atomic and molecular structures.

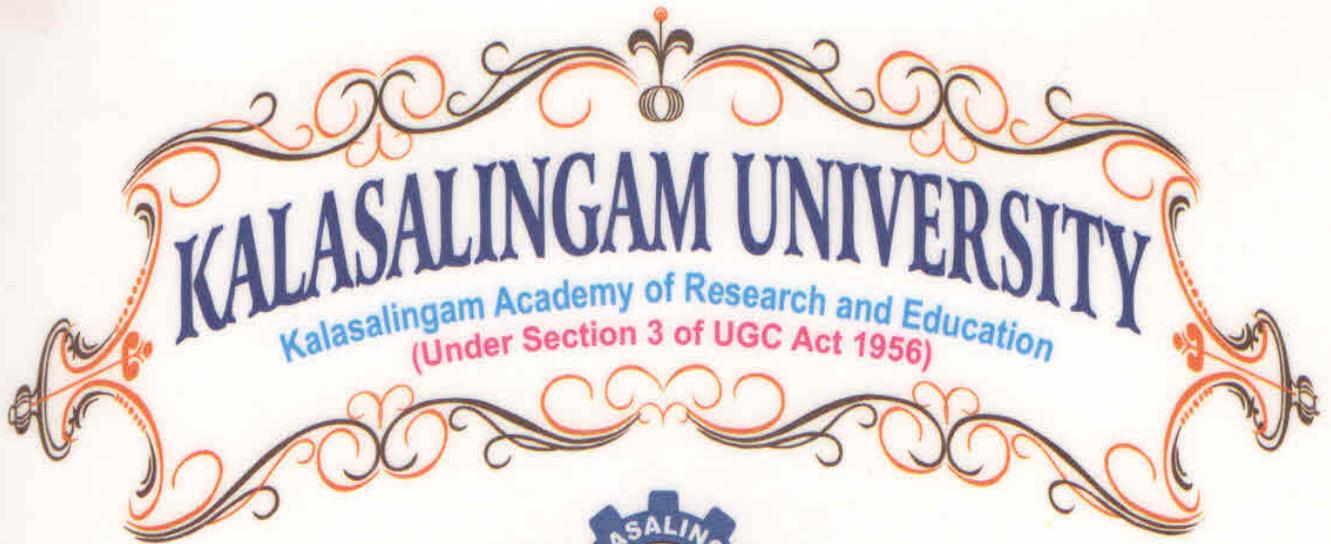
Biological synthesis of stable nanofluid can be estimated by colour change , spectral analysis and study of antimicrobial activity of nano fluid and stability analysis of nanofluid can be further studied

Wastewater treatment and energy production

Wastewater generated can be converted to nanofluid in industries and thus can be integrated into solar energy generation systems which opens up into sustainable development. Hence the work offers the reuse of wastewater generated in society as a energy source to meet the power requirements

5. Summary and Conclusions

I propose the study of eco synthesis of silver nanoparticles aqueous extracts of plants can be used as bio reduction agents to produce Ag nanoparticles. The formation of Ag nanoparticles in the extract will be observed by the colour change. Color changes may indicate that occur indicate that Ag particles have formed. The particle size of synthesized Silver nanoparticles studied. Their characterizations can be done using XRD, SEM, EDAX and FTIR spectroscopic techniques. Investigation on the antimicrobial effect of nanosized silver against various microbes may reveals high efficacy of silver nanoparticles as a strong antibacterial agent and can be used in wastewater treatment. The work introduces a simple, fast, and economical biological method to synthesize silver nanofluid with wastewater as the base fluid. This method provides a clean, nontoxic and eco-friendly and efficient route for the synthesis of nanosilver with tuneable particle size, at room temperature conditions. The nanofluid produce is of stable nature and from recent studies integration of nanofluid with solar thermal plants can increase an efficiency of 10% and gives a much larger power input. Thus the wastewater generated can be converted to nanofluid in industries and thus can be integrated into solar energy generation systems which opens up into sustainable development. Hence the This study will allow us to offers the reuse of wastewater generated in society as a energy source to meet the power requirements.



Register No : 9909102016

The Board of Management of the Kalasalingam University, hereby makes known that

Ms./Mr. **LEKSHMI R BABU**has been admitted to the

Degree of **Master of Technology in Biotechnology**

he / she having been certified by duly appointed examiners to be qualified to receive the same

and having been placed in the **First Class**

at the examination held in **Apr/May 2011**

Given under the seal of the University



Anand Nagar,
Krishnankoil - 626 190,
Tamil Nadu, India

Director (Academic)

Vice - Chancellor

Date: 03/09/2011



FACULTY OF ENGINEERING AND TECHNOLOGY

The Senate of the University of Kerala hereby makes known that *Lekshmi R. Babu* has been admitted to the Degree of Bachelor of Technology under *Bio-Technology and Bio-Chemical Engineering* Branch, she having been certified by duly appointed examiners to be qualified to receive the same and having been by them placed in the *First Class* at the examination held in *May 2007*.

Given under the seal of the University

University Buildings
Thiruvananthapuram April 04, 2008



Vice Chancellor

KALASALINGAM UNIVERSITY

Kalasalingam Academy of Research and Education
(Under Section 3 of UGC Act 1956)



Sl. No : 211128

Anand Nagar
Krishnankoil – 626 190
Tamil Nadu, INDIA



M.Tech Degree Examinations CONSOLIDATED GRADE CARD

Name of the Student: LEKSHMI R BABU

Register No: 9909102016

Branch: Biotechnology

Batch: 2009-2011

SEM	COURSE CODE	NAME OF THE COURSE	ATTENDANCE CODE	CREDITS	GRADE	MONTH & YEAR OF PASSING
CGPA COURSES						
1	BIT5001	Immunotechnology	H	3	B	Nov/Dec 2009
1	BIT5002	Downstream Processing	9	3	A	Nov/Dec 2009
1	BIT5003	Bioprocess Plant & Equipment Design	9	3	B	Nov/Dec 2009
1	BIT5004	rDNA Technology	H	3	B	Nov/Dec 2009
1	BIT5011	Bioremediation	9	3	A	Nov/Dec 2009
1	BIT5081	Genetic Engineering Laboratory	H	2	A	Nov/Dec 2009
1	MAT5001	Bio-Mathematics	9	3	A	Nov/Dec 2009
2	BIT5005	Genomics and Proteomics	9	3	A	May 2010
2	BIT5006	Transgenic Engineering	H	3	A	May 2010
2	BIT5007	Bioprocess Modeling and Simulation	9	3	A	May 2010
2	BIT5008	Bioinformatics and Drug Design	H	3	A	May 2010
2	BIT5009	Molecular Biology	9	3	B	May 2010
2	BIT5015	Clinical Physiology	9	3	B	May 2010
2	BIT5082	Bioprocess Engineering Laboratory	H	2	A	May 2010
3	BIT6002	Industrial Microbiology	H	3	A+	Nov/Dec 2010
3	BIT6004	Industrial Wastewater Treatment & Management	9	3	A	Nov/Dec 2010
3	BIT6008	Plant Biotechnology	9	3	B	Nov/Dec 2010
3	BIT6098	Thesis Part I	H	6	A	Nov/Dec 2010
4	BIT6099	Thesis part 2	H	12	A+	Apr/May 2011

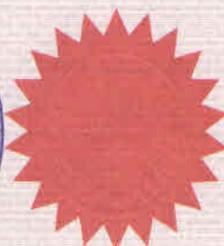
CGPA CREDITS

EARNED	TOTAL TO BE EARNED	CGPA	CLASS AWARDED
67	67	7.9552	First Class

Please see overleaf for details

Place: Krishnankoil

Date: 23/05/2011



Director (Academic)

UNIVERSITY OF KERALA

Serial No : 07 03 4922
 Ref. No. EG : 07 32 4922 O



Thiruvananthapuram
 Date : 25/08/2007

Name of Programme : B.Tech. Bio-Technology and Bio-Chemical Engineering
 Semester : 8
 Month & Year of Exam : May 2007
 Name of Student : **LEKSHMI R BABU**

Exam Code : **408 03801**
 Candidate Code : **03 409 040**

Statement of Marks

Subject Code	Subjects	Credits	Marks Awarded		
			SM	UM	Total
03801	Process Dynamics and Control	4	40	50	90
03802	Bio-informatics	4	45	71	116
03803	Bio-process Plant Design	4	49	40	89
03804	Process Instrumentation	3	42	50	92
03805	Economics and Management of Chemical Industries	4	46	71	117
03806	Immunology	4	41	56	97
03807	Reaction Engineering and Process Control Lab	3	45	78	123
03808	Project / Viva Voce / Industrial Visits	3	95	35	130
		Semester - 1 & 2			6.8
		Semester - 3			6.5
		Semester - 4			6.9
		Semester - 5			7.1
		Semester - 6			7.2
		Semester - 7			7.2
		Semester - 8			7
Result : Passed			CGPA : 6.98 (Six * Nine Eight)		

Prepared By : *Har*
 Checked By : *Har B*

Section Officer : *Subhales*

Sulakha M.P
 Controller of Examinations

* Pass requirements & papers to be cleared if any shown overleaf



KALASALINGAM UNIVERSITY

(Kalasalingam Academy of Research and Education)

(Under Section 3 of UGC Act 1956)

(Accredited by NAAC with B Grade with a CGPA of 2.81)

Anand Nagar, Krishnan Koil -626126.

Srivilliputtur (Via), Virudhunagar (Dt), Tamil Nadu, India

TRANSFER CERTIFICATE

- 1.Name of the pupil : LEKSHMI R BABU
- 2.Date of Birth : 13/11/1984
- 3.Nationality, Religion and Caste : Indian Hindu OC
- 4.Date of joining to the university : 22/7/2009
- 5.Course details
- a) Registration no. : 9909102016
- b) Degree : M.Tech
- c) Specialization : Biotechnology
- d) Batch : 2009 - 2011
- 6.Whether qualified for promotion to a higher class : Yes(Refer the Grade Sheet)
- 7.Is there any break during the studies (if so specify the period) : No
- 8.Whether the pupil has paid all the fees to the University : Yes
- 9.Date on which application for TC was made : 23/5/2011
- 10.Date on which actually the pupil left the university : 20/4/2011
- 11.Medium of instruction : English

Date : 23/5/2011



J. V. S.

REGISTRAR



SREE BUDDHA COLLEGE OF ENGINEERING

PATTOOR P.O., ALAPPUZHA DIST., KERALA. PIN - 690 529



Approved by AICTE, New Delhi & Affiliated to APJ Abdul Kalam Technological University, Kerala
Tel.0479-2375440,42,43. e-mail: principal@sbce.ac.in / sreebuddha@ktu.edu.in website: www.sbce.ac.in
Managed by Sree Buddha Educational Society, Kollam - 691 021

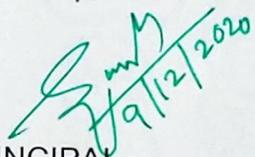
No. SBCE/ 1638 /2020-21

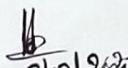
09.12.2020

EXPERIENCE CERTIFICATE

This is to certify that Ms. Lekshmi R Babu , Department of Biotechnology & Biochemical Engineering, has been working in this institution as Assistant Professor from 19.12.2011 to till date. Her conduct and character are good.

This certificate is issued on her request so as to enable her to apply for part-time PhD registration.


PRINCIPAL


9/12/2020
(H)



आयकर विभाग
INCOME TAX DEPARTMENT



भारत सरकार
GOVT. OF INDIA

LEKSHMI R BABU

BABU

13/11/1984

Permanent Account Number

AJAPL7079H

Lekshmi

(Signature of Lekshmi R. Babu)

Signature



Lekshmi



ഇന്ത്യൻ തിരഞ്ഞെടുപ്പ് കമ്മീഷൻ

ELECTION COMMISSION OF INDIA

സമ്മതിദായക ഫോട്ടോ തിരിച്ചറിയൽ കാർഡ് - ELECTOR PHOTO IDENTITY CARD



MKG1254945



പേര് : ലക്ഷ്മി ആർ ബാബു

NAME : Lekshmi R Babu

അമ്മയുടെ പേര് : രമാദേവി എ കെ

MOTHER'S NAME : Remadevi A K

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Lekshmi
10.12.2020

ലിംഗം/ SEX : സ്ത്രീ / Female

ജനനത്തീയതി / വയസ്സ്

DATE OF BIRTH/AGE : 13/11/1984 / 30

മേൽവിലാസം : 12/678, രാധാമന്ദിരം, കുന്നുകുഴി, വഞ്ചിയൂർ
695035

ADDRESS : 12/678, Radhamandiram,
Kunnukuzhy, Vanchiyoor 695035

ഇലക്ടറൽ രജിസ്ട്രേഷൻ ഓഫീസർ
Date: 20/09/2015 ELECTORAL REGISTRATION OFFICER

അസംബ്ളി നിയോജകമണ്ഡലം : 133, വട്ടിയൂർക്കാവ്
നമ്പറും പേരും

ASSEMBLY CONSTITUENCY No. : 133,
& NAME VATTIYOORKAVU

പാർട്ട് നമ്പർ : 134
PART No.

NOTE / കുറിപ്പ്

1. Mere possession of this card is no guarantee that you are elector in the current electoral roll. Please check your name in the current electoral roll before every election.

1. ഈ കാർഡ് കൈവശമുള്ളത് കൊണ്ട് മാത്രം നിങ്ങൾ നിലവിലുള്ള വോട്ടർ പട്ടികയിൽ ഒരു സമ്മതിദായകൻ ആകണമെന്നില്ല. ഓരോ തെരഞ്ഞെടുപ്പിനും മുമ്പായി നിലവിലുള്ള വോട്ടർ പട്ടികയിൽ നിങ്ങളുടെ പേര് ഉണ്ടോയെന്ന് പരിശോധിക്കേണ്ടതാണ്.

2. Date of Birth mentioned in this card shall not be treated as a proof of age/D.O.B. for any purpose other than registration in electoral roll.

2. ഈ കാർഡിൽ സൂചിപ്പിച്ച ജനനത്തീയതി വോട്ടർ പട്ടികയിൽ രജിസ്റ്റർ ചെയ്യുന്നതിനല്ലാതെ ജനനത്തീയതി/വയസ്സ് തെളിയിക്കുന്നതിനുള്ള ഒരു രേഖയായി പരിഗണിക്കുവാൻ പാടില്ല.

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SREE BUDDHA COLLEGE OF ENGINEERING

PATTOOR P.O., ALAPPUZHA DIST., KERALA. PIN - 690 529



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Tel.0479-2375440,42,43. e-mail: principal@sbce.ac.in / sreebuddha@ktu.edu.in website: www.sbce.ac.in
Managed by Sree Buddha Educational Society, Kollam - 691 021

No. SBCE/ 1639 Ph.D/2020-21

09.12.2020

ANNEXURE -1

CERTIFICATE FROM THE ORGANISATION WHERE THE CANDIDATE IS EMPLOYED

Certified that Mr/ Ms/ Mrs/ Lekshmi R Babu is employed as Assistant Professor in the Department of Biotechnology & Biochemical Engineering of Sree Buddha College of Engineering, Pattor.

We have no objection in forwarding her application for the part time Ph. D Research programme.

The Candidate will be permitted to undertake part time study in the university/ College and will be allowed to be present for discussion with the supervisor, attending course works, conduct of experiments and participations in seminars and related presentations. Further the required facilities at our organization will also be provided to the candidate for doing research.

Date:09.12.2020

Signature of the Head of organization with office seal

9/12/2020
(AO)

