

3.3.1 - Institution's Innovation Council



ALAGAPPA UNIVERSITY

(A State University Established in 1985)
KARAIKUDI - 630 003, Tamil Nadu, India
www.alagappauniversity.ac.in



INSTITUTION'S
INNOVATION
COUNCIL
(Ministry of HRD Initiative)

INSTITUTION'S INNOVATION COUNCIL - ALAGAPPA UNIVERSITY (IIC-ALU)



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About the IIC Institute

Alagappa University is a state University, located at Karaikudi in Tamil Nadu. The University was brought into existence by a Special Act of the Government of Tamil Nadu in **May 1985** with the objective of fostering research, development and dissemination of knowledge in various branches of learning.

The University has 44 Departments, 9 Centres and 2 Constituent Colleges on its campus. 46 Affiliated Colleges located in the districts of Sivaganga and Ramanathapuram are part of the University.

Alagappa University has achieved many milestones. A few of them are as under;

- Obtained **A+ Grade** with CGPA of 3.64 grading by the National Assessment and Accreditation Council (NAAC). Alagappa University is the first State University in Tamil Nadu to obtain the A+ grade.
- Obtained **Category-I status** by the UGC and occupies 2nd place out of 12 State Universities with Category-I Status in the Country. It is the only State University in Tamil Nadu obtained the Category-I Status.
- Obtained Autonomy status (one among 60 Institutions in the country announced by MHRD).
- Secured **33rd** position among Universities in National Institutional Ranking Framework (**NIRF**) **2021** ranking.
- Secured with in **501-600** ranking in **THE World University Ranking 2022**.
- Secured **24th** position in **QS India Ranking** in 2021.
- It is the only University in Tamil Nadu which has been sanctioned Rs.100 crores under MHRD - RUSA 2.0 Scheme.

Vision / Mission of IIC

- To promote innovation and entrepreneurship eco-system in the campus
- To train the youth as innovators and self-reliant with Industry specific Technical, Generic and Life Coping Skills
- To provide support for startup / entrepreneurial ventures
- To promote the holistic development of youth in terms of career goals, decision making and livelihood options

Journey of IIC

- IIC established in Alagappa University : March 2021
- First Council Meeting : 28.07.2021
- Activities Started (formal) : August 2021

Diversification of IIC

- The Institution's Innovation Council - Alagappa University (IIC-ALU) consisting of **33 members**:
 - Besides **President, Vice-President** and **Convener (3)**, there are
 - **Six Faculty-level** and **six student-level activity coordinators** for Innovation, Start-up, Internship, IPR, Social Media, NIRF related activities (**12**),
 - **Six External members** (Patent Expert, Alumni Entrepreneurs (among two one from Singapore), Angel Investor, nearby Incubation Centre), (**6**)
 - **Six Faculty members** and **six students** as members (**12**)

Key Functionaries of the IIC-ALU

S.No.	Name & Address	Role in the IIC-ALU
1	Vice-Chancellor Alagappa University	President
2	Dr. C. Sekar Registrar i/c, Alagappa University	Vice-President
3	Dr. G. Ilankumaran Director i/c, EIC Hub, Alagappa University	Convener
4	Dr. S. Karutha Pandian Sr. Professor & Head, Dept. of Biotechnology Coordinator, IPR Cell, Alagappa University	IPR Activity Coordinator
5	Dr. K. Sankaranarayanan Director, USIC, Alagappa University	Innovation Activity Coordinator
6	Dr. J. Jeyakanthan Director, Alagappa University Ranking Cell, Coordinator-NIRF, Alagappa University	NIRF Coordinator(ALU-IIC)
7	Dr. C. K. Muthukumaran Coordinator, Entrepreneurship Development Cell Professor, Alagappa Institute of Management Alagappa University	Start-up Activity Coordinator
8	Dr. S. Gopalsamy Deputy Coordinator, Placement Cell Alagappa University	Internship Coordinator
9	Dr. C. Balakrishnan Asst. Professor, AISD, Alagappa University	Social Media Coordinator

Category and Strength of the Members in IIC-ALU

S.No.	Category of Responsibilities	Number of Members
1	Faculty-level Activity Coordinators	6
2	Student-level Activity Coordinators	6
3	External Members	6
4	Faculty Members	6
5	Student Members	6

Highlight Facilities, Infrastructure of Pre-Incubation & Incubation in promotion of Innovation and Entrepreneurship in the campus

Common Research Facility - USIC



MALDI – TOF Mass Spectrometry



Confocal Laser Scanning Microscope (CLSM)



Biological Molecule Purifier



Scanning Electron Microscope (SEM)



Proton NMR Spectrometer



Powder XRD

University Science Instrumentation Centre (USIC)

High-end Equipment worth ~ **Rs. 25 Cr.**

- o Common research facility for all Science Departments and Affiliated Colleges
- o Extending the facilities and services to the neighboring Universities and Institutions
- o Providing Consultancy services to the Industries



X-Ray Photoelectron Spectroscopy (XPS)



Transmission Electron Microscopy (TEM)

Existing Research Ecosystem

High-tech Laboratories in the Cutting edge Areas – **Biological Sciences**



Cell Culture
(Dept. of Biotechnology)



Protein Crystallization
(Dept. of Bioinformatics)



Plant Tissue Culture
(Dept. of Botany)



Molecular Imaging
(Dept. of Animal Health and Management)



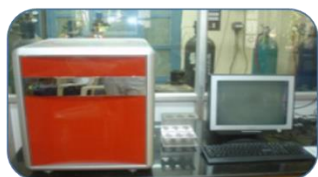
Gas chromatography
(Dept. of Microbiology)



Scuba Diving
(Dept. of Oceanography and Coastal Area Studies)

Highlight Facilities, Infrastructure of Pre-Incubation & Incubation in promotion of Innovation and Entrepreneurship in the campus

High-tech Laboratories in the Cutting edge Areas – **Physical & Chemical Sciences**



CHNS/O Elemental Analyser
(Dept. of Industrial Chemistry)



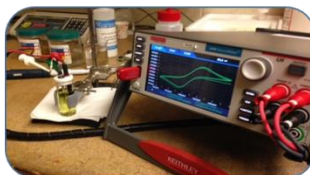
Spin Coating Unit
(Dept. of Energy Science)



Photo-catalytic
(Dept. of Nanoscience and Technology)



DC, RF & Pulsed sputtering
(Dept. of Physics)



Cyclic Voltammetry
(Dept. of Bioelectronics and Biosensors)

State-of-the-art Learning Resources

Field Laboratories



Aqua Culture Pond
(At present 12,000 fishes)



Botanical Garden



Modular Laboratory



High-end Computer Laboratory



Smart Classroom

Radio Frequency Identification Device (RFID) Enabled Library



Anti-theft security gates



Self-check kiosks (borrow)



Self-check kiosks (return)



Language Lab



E-Studio

Highlight Facilities, Infrastructure of Pre-Incubation & Incubation in promotion of Innovation and Entrepreneurship in the campus

Prior to the Formation of the IIC, the Alagappa University is implementing Skill Development, Innovation and Entrepreneurship Activities through 'Alagappa Institute of Skill Development' and its units:

Alagappa Institute of Skill Development

- **Alagappa Institute of Skill Development (AISD)** is an unique Department for Skill Development / Vocational Education since April 2013. A pioneering initiative to **enhance skills of rural youth** to meet the demands of industrialization.
- **Four Skill training units** are functioning under AISD,
 1. **Garment Training Unit (GTU)** since 2006
 2. **Alagappa University-Learnnet Institute of Skills (AU-LIS)** since 2013
 3. **Vocational Degree Programmes** since 2014
 4. **Entrepreneurship, Innovation and Career Hub (EIC Hub)** since 2019
 5. **Innovation and Entrepreneurship Development Programme Hub (IEDP Hub)** of EDII-TN since 2020
- AU-LIS (previously known as IL&FS Institute of Skills) is **Country's first institute under Public-Private-Partnership (PPP) model** in association with IL&FS Institute of Skills, New Delhi offering University recognized Skill training programmes adherence to the National Occupational Standards (NOS).
- 79% of trained youths got employment opportunities.



Entrepreneurship, Innovation and Career Hub – Alagappa University

- Under RUSA 2.0 Scheme, with the financial outlay of Rs. 15 Cr. the **Entrepreneurship, Innovation and Career Hub** was established in Alagappa University. This has been digitally Launched by the **Hon'ble Prime Minister of India** on **3rd February, 2019**.
- The following Laboratories / Learning Facilities are established in the EIC Hub
 - **CNC Mill Semi-Production Cum Trainer Unit**
 - **Internet of Things (IoT) Laboratory**
 - **Hi-tech Fashion Design Laboratory**
 - **Healthcare lab**
 - **Hi-tech Design lab** with CAE software
 - **Smart Classrooms & Video Conferencing Facility**

Conceptual Framework



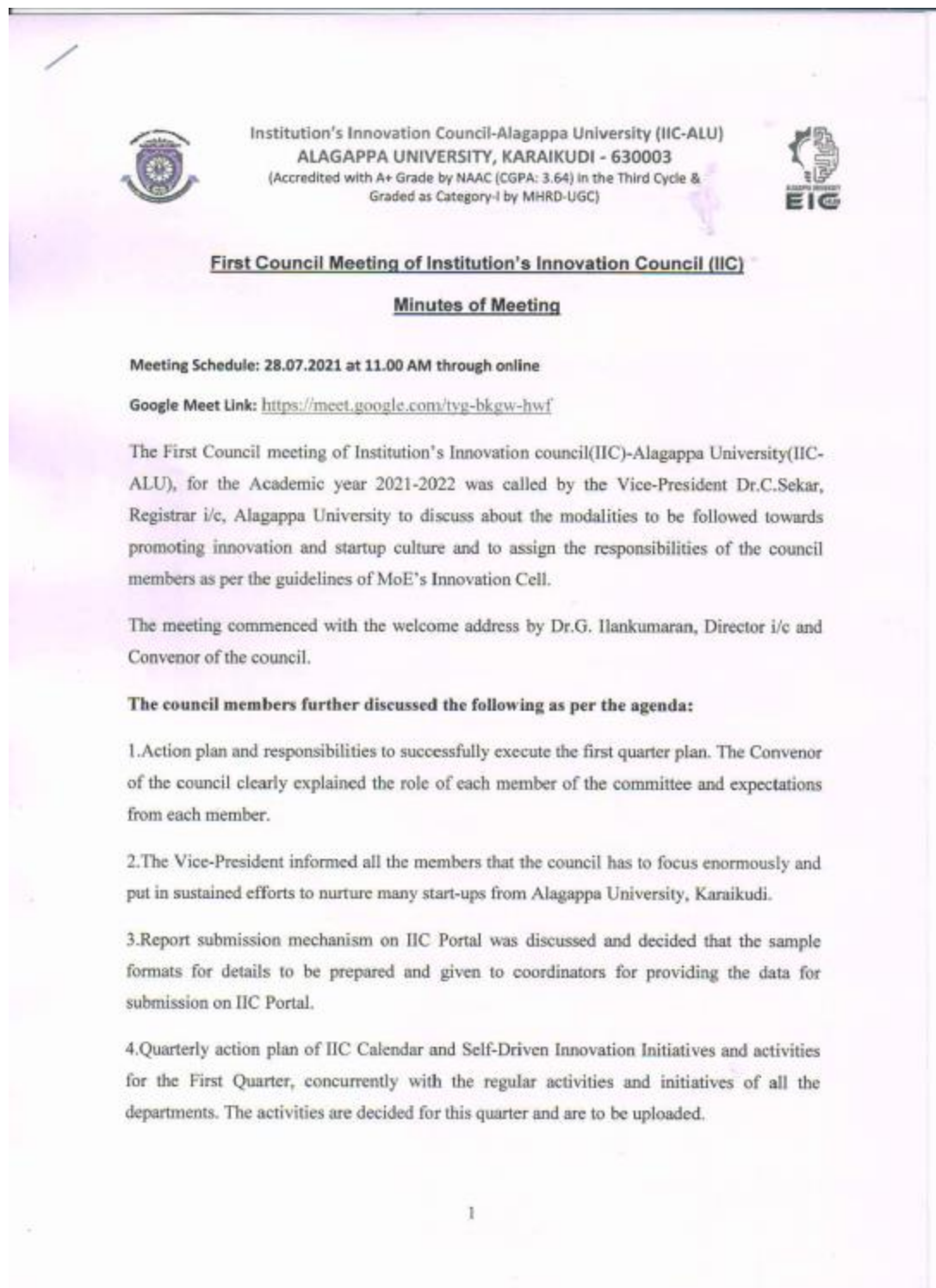
Abstract of Activities

S.No.	Category of Activity	Number of Activities
1	IIC Calendar Activities	12
2	MIC Driven Activities	2
3	Self-Driven Activities	1
Total (Activities)		15



IIC Calendar Year
(2020-21)

Quarter	Category	Activity	Date of Event
Q1	IIC Calendar	IIC Council Formation	28.7.2021



Quarter	Category	Activity	Date of Event
Q1	IIC Calendar	IIC Council Formation	28.7.2021

Outcomes of the Meeting:

- 1.The council unanimously decided to carry out all the IIC activities in regular basis throughout the year and meet regularly on every quarter to review the progress made and also to plan for upcoming quarters.
- 2.Initiatives to ignite the entrepreneurial aptitude of the students, scholars and faculty members of Alagappa University, Karaikudi.

The Following IIC-ALU members attended the online meeting on 28.07.2021:

S. No.	Name of Member	Member Type (Teaching/ Non-teaching / External Expert)	Key Role / Position assigned in IIC
1	DR.R. SWAMINATHAN	Teaching	President
2	Dr. T.R. GURUMOORTHY	Teaching	President
3	DR. C. SEKAR	Teaching	Vice-President
4	DR. G. ILANKUMARAN	Teaching	Convener
5	DR. S. KARUTHA PANDIAN	Teaching	IPR Activity Coordinator
6	DR. K. SANKARANARAYANAN	Teaching	Innovation Activity Coordinator
7	DR. J. JEYAKANTHAN	Teaching	NIRF Coordinator(ALU-IIC)
8	DR. C. K. MUTHUKUMARAN	Teaching	Start-up Activity Coordinator
9	DR. S. GOPALSAMY	Teaching	Internship Coordinator
10	DR. C. BALAKRISHNAN	Teaching	Social Media Coordinator
11	DR. P. S. NAGARAJAN	Teaching	Member - Faculty
12	DR. G. GOPU	Teaching	Member - Faculty
13	DR. S. SANTHOSHKUMAR	Teaching	Member - Faculty
14	DR. M. SUTHA	Teaching	Member - Faculty
15	MR. R. RAJKUMAR	Non-Teaching	Member - Faculty
16	MR. SP. ALAGU RAMAN	Non-Teaching	Member – Faculty

Quarter	Category	Activity	Date of Event
Q1	IIC Calendar	IIC Council Formation	28.7.2021

S. No.	Name of Member	Member Type (Teaching/ Non-teaching / External Expert)	Key Role / Position assigned in IIC
17	M/S. LAKSHMI KUMARAN & SRIDHARAN ATTORNEYS	External Expert	IP Expert / Patent Expert (External)
18	MR. KA. VINODHAN	External Expert	Startup / Alumni Entrepreneur (External)
19	DR. V. SWAMINATHAN	External Expert	Startup / Alumni Entrepreneur (External)
20	MR. L. SEVUGAN ANNAMALAI	External Expert	Expert from nearby Industry / Industry association / Ecosystem Enablers (External)
21	MR. P. SIVAKUMAR	External Expert	FI / Bank / Investor / Angel Investor / VC (External)
22	MS. GITA CHENGAPPA	External Expert	Nearby Incubation Centre (External)
23	MR. M. ANGAPPAN	Student	Innovation Coordinator (Student)
24	DR. A. IYAPPAN	Student	Startup Coordinator (Student)
25	MR. R. ARAVIND KRISHNA	Student	Internship Coordinator (Student)
26	MS. B.C. MUTHUBHARATHI	Student	IPR Coordinator (Student)
27	MR. S. AADHEESHWARAN	Student	IPR Coordinator (Student)
28	MS. E. SWETHA	Student	Social Media Coordinator (Student)
29	MR. VEERAPANDIYAN MALAISAMY	Student	General Member (Student)
30	MR. JOAN GODWIN	Student	General Member (Student)
31	MR. R. KALAIARASAN	Student	General Member (Student)
32	MR. S. DINESH	Student	General Member (Student)
33	MS. A. SALI MARIA CLARAT	Student	General Member (Student)
34	MR. K. MURUGANANTHAM	Student	General Member (Student)

Date: 28.07.2021




Convenor-IIC
Dr. G. ILANKUMARAN
Director
Alagappa Institute of 3rd Development
Alagappa University
Karaikudi- 630 003


Vice-President, IIC
REGISTRAR
ALAGAPPA UNIVERSITY
KARAIKUDI

Quarter	Category	Activity	Date of Event
Q1	IIC Calendar	Orientation Session on National Education Policy	25.08.2021
Webinar on 'National Education Policy for Innovation'			



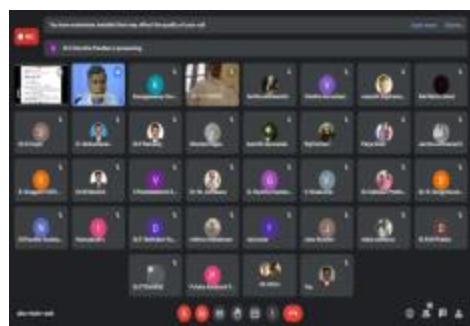
Institution's Innovation Council- Alagappa University (IIC-ALU) organized a virtual event, Webinar on “**National Education Policy for Innovation**” on **25th August 2021** in collaboration with **Internal Quality Assurance Cell (IQAC)**, Entrepreneurship, Innovation and Career Hub, Alagappa University and Entrepreneurship Development and Innovation Institute-TN (EDII-TN), Chennai.

The programme commenced with a welcome address by Dr. G. Ilankuaran, Convenor, IIC-ALU and Director i/c, EIC Hub Alagappa University welcomed the attendees of the webinar. Dr. G. Gopu, Member (Faculty), IIC-ALU and Asst. Professor, Dept. of Industrial Chemistry introduced the Resource Person to the attendees.

Prof. S. Karutha Pandian, Director-IQAC and Dean-Faculty of Science, Alagappa University has delivered special address on the significances of National Education Policy on Innovation. He elaborately explained the thrust in the NEP given for enhancing innovation eco-system in academic campuses. He also illustrated the benefits of improving the interest of the stakeholders on innovation towards getting good positions in various national and international raking frameworks and accreditation processes. Finally, he answered the queries of the participants related to the nuances of NEP with respect to innovation.

90 participants have participated the webinar.

Ms. B. C. Muthubharathi, Student-level IPR Coordinator, IIC- ALU and Research Scholar, Dept. of Biotechnology has proposed the vote of thanks.



Quarter	Category	Activity	Date of Event
Q1	IIC Calendar	Seminar & Panel Discussion on Atmanirbhar Bharat	25.01.2021

Special Lecture and Interaction Meet on 'Atmanirbhar Bharat'

A **Special Lecture on Atmanirbhar Bharat & Interaction Meet** with Pt. Deendayal Upadhyay Study group members has been organized by Pandit Deendayal Upadhyay Chair of Alagappa University on 25.01.2021.

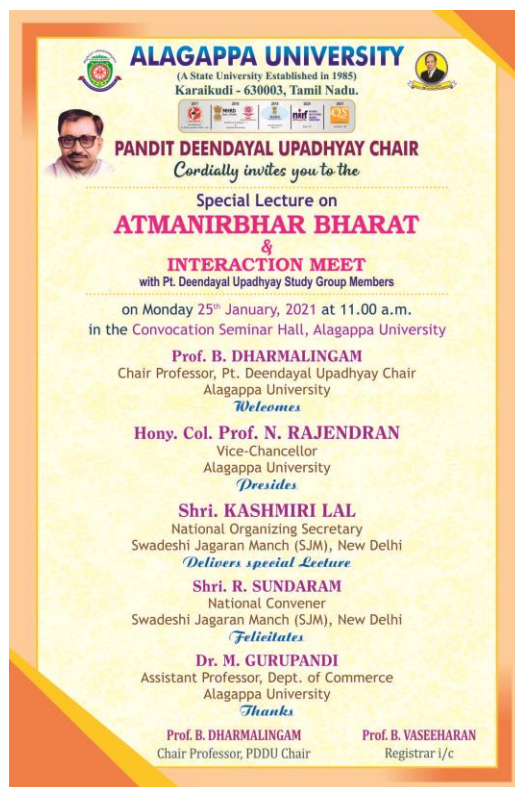
In his presidential address **Prof. N. Rajendran**, Vice-Chancellor, Alagappa University has said, Atmanirbhar Bharat, which translates to 'self-reliant India' or 'self-sufficient India', is a policy, the term is coined by Prime Minister of India, Shri. Narendra Modi for making India "a bigger and more important part of the global economy", pursuing policies that are efficient, competitive and resilient, and being self-sustaining and self-generating. The first mention of this came in the form of the 'Atmanirbhar Bharat Abhiyan' or 'Self-Reliant India Mission' during the announcement of India's COVID-19 pandemic related economic package on 12 May 2020. Pandit Deendyal Upadhyaya speaks of "keeping the nation's identity alive so much so that even if we have to acquire something from outside, we do so in a way that it should become our own." This was one of the fundamental positions on which the entire narrative of India's self-dependence had to stand.

Shri. Kashmiri Lal, National Organizing Secretary, Swadeshi Jagaran Manch (SJM), New Delhi has delivered the special lecture on 'Atmanirbhar Bharat'.

Shri. R. Sundaram, National Convener, Swadeshi Jagaran Manch (SJM), New Delhi has offered his felicitations.

66 participants were participated. The resource persons have interacted with the participants and members of Pt. Deendayal Upadhyay Study group on the significances of Atmanirbhar Bharat and answered the queries of the participants and PDDU study group members.

Dr. M. Gurupandi, Asst. Professor, Dept. of Commerce, Alagappa University proposed the vote of thanks.



Quarter	Category	Activity	Date of Event
Q1	IIC Calendar	Workshop on 'Entrepreneurship and Innovation as Career Opportunity'	02.08.2021

Webinar on 'Entrepreneurship and Innovation as Career Opportunity'



Institution's Innovation Council- Alagappa University (IIC-ALU) Organized a virtual event “**Entrepreneurship and Innovation as Career opportunity**” on **2nd August 2021** in collaboration with Entrepreneurship, Innovation and Career Hub, Alagappa University and Entrepreneurship Development and Innovation Institute-TN (EDII-TN), Chennai.

The programme commenced with a welcome address by Dr. G. Ilankumaran, Convener- IIC ALU & Director i/c- EIC Hub. Prof. C.Sekar Vice-president, IIC-ALU & Registrar i/c of Alagappa University inaugurated the programme.

In his felicitation, Prof. B. Dharmalingam Advisor, EIC hub, he emphasized, “Innovation is important for the entrepreneurs and they should enhance the business model. Create the brand Improve it, change it, make it success”. Dr. A. Iyappan, student-level Startup Coordinator, IIC-ALU, introduced the speaker to the attendees, and stated some points on rural basket.

The special addresses was delivered by **Mr V. Palani Rajan, Ruralpreneur, Founder- Rural basket.com| Ruralshop.com**, he started his lecture with the question ‘why entrepreneurship?’ he stated that, all over the world, companies have started to introduce automation, so the next generation has to create mass entrepreneurship. He motivated the participants to have the innovative thinking to become an entrepreneur. He specifically pointed out “find the mentor for proper guidance to forecast and to avoid mistakes in all phases of entrepreneurship”.

220 have registered for the Webinar and 100 have participated.

Dr. C. Balakrishnan, Social Media Coordinator, IIC-ALU proposed vote of thanks.



Quarter	Category	Activity	Date of Event
Q1	IIC Calendar	Motivational Session by Successful Innovators	06.08.2021

Webinar on 'Startup success story- Diginadu'

Institution's Innovation Council- Alagappa University (IIC-ALU) Organized a virtual event "**Startup success story- Diginadu**" on **6th August 2021** in collaboration with Entrepreneurship, Innovation and Career Hub, Alagappa University and Entrepreneurship Development and Innovation Institute-TN (EDII-TN), Chennai.

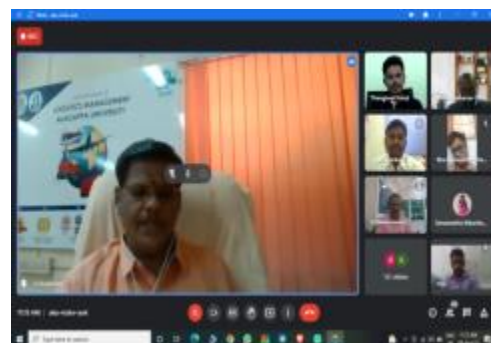
The programme was commenced with a welcome address by Dr. C. K. Muthukumar, Startup Activity Coordinator- IIC-ALU, Professor, Alagappa Institute of Management. Prof. V. Sivakumar, Dean i/c, College Development Council, Professor & Head, Dept. of Logistics Management inaugurated the webinar.

Dr. S. Gowrishankar, Asst. Professor, Dept. of Biotechnology has introduced the special guest to the attendees.

Mr P. Thangavel- CEO Diginadu & CMO-NX gen digital delivered the special address on his Startup success story. He shared his startup experience, and what motivates to become an entrepreneur and the turning points of his life and entrepreneurial endeavours. He stated the necessary required virtues for the budding entrepreneurs to reach the goal. He also narrated opportunities in digital servicing for promoting the brand and its values. He finally said that- Helping others' Grow is the only way to Grow!

216 have registered for the Webinar and 163 have participated.

Mr Joan Godwin- II M.Sc, Nanoscience & Technology, Student Member- IIC-ALU, proposed the vote of thanks.



Quarter	Category	Activity	Date of Event
Q2	IIC Calendar	Workshop on Design Thinking, Critical thinking and Innovation Design	19.08.2021

Webinar on ‘Problem Solving and Ideation’

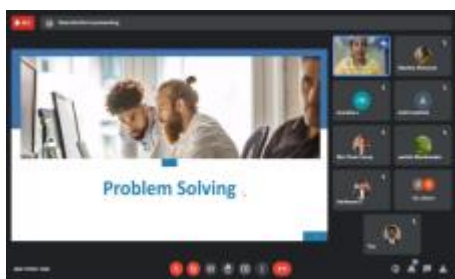
Institution’s Innovation Council- Alagappa University (IIC-ALU) organized a virtual event, Webinar on “**Problem Solving and Ideation**” on **19th August 2021** in collaboration with Entrepreneurship, Innovation and Career Hub, Alagappa University and Entrepreneurship Development and Innovation Institute-TN (EDII-TN), Chennai.

The webinar was commenced with a welcome address by Dr. A. Iyappan, Student-level Startup Coordinator, IIC-ALU & ICSSR Post-Doctoral Fellow, Alagappa Institute of Management. Prof .T. R .Gurumoorthy, Member, Vice-Chancellor’s Officiating Committee, Senior Professor & Head, Dept. of Commerce, Alagappa University has inaugurated the programme. Dr. C. Balakrishnan, Social Media Coordinator, IIC-ALU introduced the special guest to the attendees.

In her invited talk, **Ms P. Sharmila Devi, NLP Master Coach, Founder & CEO, Seven Clover Coaching Services & Chapter Co-Director, Startup Grind, Madurai** delivered her special lecture on importance and need of problem solving and ideation. She elaborated on the methodologies in drafting Startup plans and how to analysis the market. Which type of business in booming and she explained about the reputed company policy and ethics.

156 have registered for the Webinar and 111 have participated.

Mr. M. Veerapandian, Student Member, IIC-ALU & Ph.D. Research Scholar, Dept. of Bioinformatics has proposed the vote of thanks.



Quarter	Category	Activity	Date of Event
Q2	IIC Calendar	Session on Process of Innovation Development	27.08.2021
Webinar on 'Refine Your Idea into Startup'			

Institution's Innovation Council- Alagappa University (IIC-ALU) organized a virtual event, Webinar on **"Refine Your Idea into Startup"** on **27th August 2021** in collaboration with Entrepreneurship, Innovation and Career Hub, Alagappa University and Entrepreneurship Development and Innovation Institute-TN (EDII-TN), Chennai.

The webinar was commenced with a welcome address by Dr. P.S. Nagarajan, Member (Faculty), IIC-ALU & Assistant Professor, Alagappa Institute of Management. Dr. V. Swaminathan, Founder & Managing Director, Galaxy Group of Companies, Singapore and External Member & Startup / Alumni Entrepreneur, IIC-ALU has inaugurated the programme. Dr. S. Santhoshkumar, Asst. Professor Dept. of computer science & Member (Faculty), IIC-ALU, introduced the speaker to the attendees.

Ms. N. Venkadeswari, Head, Startup Initiatives, Nativelead Foundation, Madurai delivered her special address on "Refine your Idea into Startup". In her address, she explained how budding entrepreneurs should refine / fine tune their ideas into a product. She elaborately discussed about the studies to be conducted like market analysis, financial analysis, crisis management and etc. by the entrepreneurs to sustain in their respective businesses. During the webinar, she gave some simple problems to the participants to find the solutions and discussed the viable solutions.

196 participants have attended the Webinar.

Mr. S. Aadheeswaran, Student Member, IIC-ALU & Ph.D. Research Scholar, Dept. of Physics has proposed the vote of thanks.



Quarter	Category	Activity	Date of Event
Q2	Self-Driven	Cyber Hackathon T20	28.12.2020

'Cyber Hackathon T20'



Date of Event
28.12.2020

Event	Time
Quizophile (Quiz)	09.00 am -09.30 am
Cyber Sketch (Drawing)	10.00 am – 01.30 pm
Stop the Spam (Innovative Idea)	10.00 am – 11.30 am



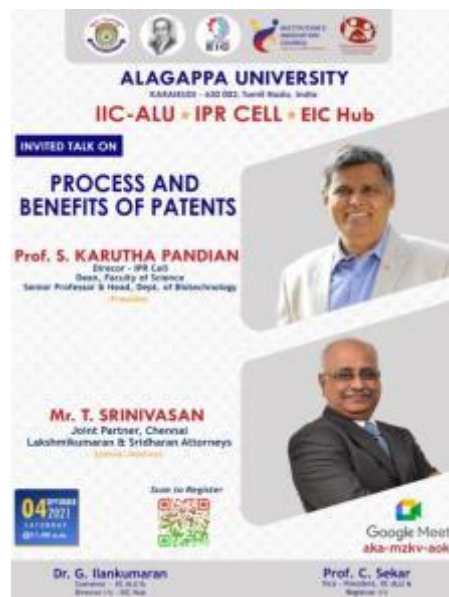
Total Number of Participants
137

Quarter	Category	Activity	Date of Event
Q3	IIC Calendar	Workshop on Intellectual Property Rights (IPRs) and IP management for start up	04.09.2021

Invited Talk on 'Process and Benefits of Patents'

Institution's Innovation Council- Alagappa University (IIC-ALU) organized a virtual event, Invited Talk on "Process and Benefits of Patents" on 4th September 2021 in collaboration with IPR Cell, Entrepreneurship, Innovation and Career Hub, Alagappa University and Entrepreneurship Development and Innovation Institute-TN (EDII-TN), Chennai.

The programme commenced with a welcome address by Dr. G. Ilankumar, Convenor, IIC-ALU and Director i/c, EIC Hub Alagappa University. Mr. J. Arumai Ruban, Field Coordinator, IEDP Hub, EDII-TN has introduced the Resource Person to the attendees. **Prof. S. Karutha Pandian**, Director-IQAC and Dean-Faculty of Science, Alagappa University has delivered presidential address. In his address, he explained the functionalities and future plans of the IPR Cell of Alagappa University in promoting IPR related activities in the University.



Mr. T. Srinivasan, Joint Partner-Chennai, Lakshmikumaran & Sridharan Attorneys has delivered an invited talk on the process and significances of filing patents for the innovative ideas. He illustrated the importance of protecting innovative ideas through patents with lot of case studies. He also explained the processes, stages, laws and other related guidelines in getting patents. Finally, he answered the queries of the participants related to the getting patents for the innovation.

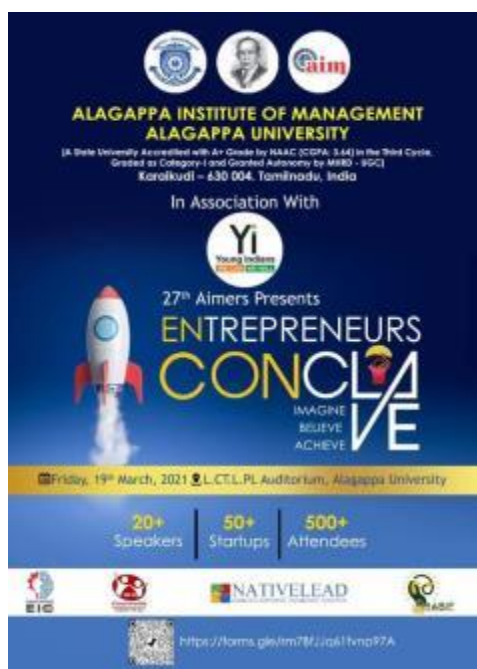


102 participants have attended the webinar.

Ms. B. C. Muthubharathi, Student-level IPR Coordinator, IIC- ALU and Research Scholar, Dept. of Biotechnology has proposed the vote of thanks.

Quarter	Category	Activity	Date of Event
Q3	IIC Calendar	Interactive Session with "Successful Start-up founders" (Entrepreneurs in Campus)	19.03.2021

Entrepreneurs Conclave - 2021



Entrepreneurs Conclave & two Panel Discussion with 20+ Speakers and 50+ Startups with 700+ Attendees has been organized by **27TH AIMERS** of Alagappa University on 19.03.2021.

In his presidential address **Prof. N. Rajendran**, Vice-Chancellor, Alagappa University with the entrepreneurial introduction that was aimed at fostering entrepreneurial skills among students and the event mainly focused on bringing the young minds with the finest mentors, Businessmen and Entrepreneurs. With the vast benefits of entrepreneurial experience and the huge advantage for those who start learning about and building businesses in their teen years, encouraging young entrepreneurship is one of the best ways to set our kids up for succession in the future. This is the perfect way for the youth to begin exploring their interests and talents and learn just how they can use these gifts to their advantage in their future careers.



700+ participants were participated. The resource persons have interacted with the participants and members of the Panelist on the significances of Entrepreneurs and answered the queries of the participants.



Mr. **R.Kalaiarasan**, Event coordinator, ENCON 2k21 proposed the vote of thanks.

Panel Discussion on "Agripreneurship – Time to lead" & Panel Discussion on "Innovation in Entrepreneurship Eco Systems" are also conducted as part of the Entrepreneurs Conclave 2021.

Quarter	Category	Activity	Date of Event
Q4	IIC Calendar	Session on Building an Innovation/ product fit for market	06.08.2021

Webinar on 'Creativity Matters'

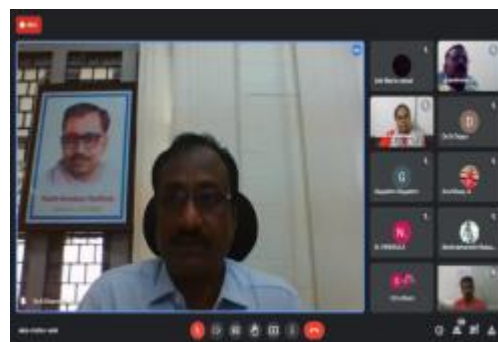
Institution's Innovation Council- Alagappa University (IIC-ALU) organized a virtual event, Webinar on "Creativity Matters" on **13th August 2021** in collaboration with Entrepreneurship, Innovation and Career Hub, Alagappa University and Entrepreneurship Development and Innovation Institute-TN (EDII-TN), Chennai.

The programme commenced with a welcome address by Dr. S. Gopaldaswamy, Internship Coordinator, IIC-ALU and Asst. Professor, Dept. of International Business, Alagappa University. Prof. B. Dharmalingam, Advisor EIC Hub and Chair Professor, Pt. Deendayal Upadhyay Chair, Alagappa University inaugurated the webinar. Dr. G. Gopu, Member (Faculty), IIC-ALU and Asst. Professor, Dept. of Industrial Chemistry introduced the Resource Person to the attendees.

Dr. P. Uma Maheswari Founder & CEO - TechWorx India Incubation Manager – ABLEST, delivered special address on the significances of Creativity. She pointed out that Creativity is one of the very important attributes for the successful Innovators and Entrepreneurs. Being creative helps us to become a better problem solver in all areas of our life and work. Creativity helps to see things differently and better deal with uncertainty. She gave some insightful demos and small interactive small assignments to develop creative skills.

244 have registered for the Webinar and 171 have participated.

Ms. B. C. Muthubharathi, Student-level IPR Coordinator, IIC- ALU and Research Scholar, Dept. of Biotechnology has proposed the vote of thanks.



Quarter	Category	Activity	Date of Event
Q4	IIC Calendar	Session on Accelerators/Incubation - Opportunities for the Students & Faculties - Early Stage Entrepreneurs	09.09.2021

Webinar on 'Incubation Support for Early Stage Entrepreneurs'



Institution's Innovation Council- Alagappa University (IIC-ALU) organized a virtual event, Webinar on **"Incubation Support for Early Stage Entrepreneurs"** on **9th September 2021** in collaboration with Entrepreneurship, Innovation and Career Hub, Alagappa University and Entrepreneurship Development and Innovation Institute-TN (EDII-TN), Chennai.

The webinar was commenced with a welcome address by Mr. J. Arumai Ruban, Field Coordinator, IEDP Hub, EDII-TN. Prof. K. Sankaranarayanan, Member of the Syndicate & Director-USIC, Innovation Activity Coordinator, IIC-ALU has inaugurated the programme. Dr. G. Ilankumar, Convenor, IIC-ALU has introduced the speaker to the attendees.

Mr. P. Sivakumar, CEO, NABARD-MABIF delivered a special address on "Incubation Support for Early Stage Entrepreneurs". In his address, he explained about the various incubation options available for early stage entrepreneurs. He also explained the ways to approach pre-incubation centres to get technical and financial assistances. He further illustrated various early stage entrepreneurs who are working in NABARD-MABIF as case studies. He called upon the participating students to develop their innovative ideas as viable entrepreneurial ventures and approach the related incubation centres.

167 participants have attended the Webinar.

Dr. C. Balakrishnan, Social Media Coordinator, IIC-ALU has proposed the vote of thanks.

Quarter	Category	Activity	Date of Event
Q4	MIC Driven	National Webinar on Research, Innovation and Ranking	11.08.2021

National Webinar on Research, Innovation and Ranking

National Webinar on Research, Innovation, and Ranking

- This Webinar is organized as the part of one-year celebration of National Education Policy 2020 (NEP 2020)
- Participated Link : <https://www.youtube.com/MHRDIInnovationCell>
- Date: 11th August 2021 Wednesday (10.30AM –1:30 PM)

S.No	Participants	Number of Participants
1	IIC – Alagappa University members	25
2	Non-IIC members of Alagappa University	80
	Total	105

Glimpses of Participation



Quarter	Category	Activity	Date of Event
Q4	MIC Driven	World Entrepreneurs Day Celebration	21.08.2021 & 24.8.2021

S.No.	Date	Activity	Title	Number of Participants
1	21.8.2021	Webinar	Upskilling and Reskilling- The future of Entrepreneurship	60
2	24.8.2021	Virtual Panel Discussion	Startup Opportunities for Aspiring Entrepreneurs	266



**ALAGAPPA INSTITUTE OF MANAGEMENT
ALAGAPPA UNIVERSITY**
(A State University Established in 1985)
KARAIKUDI - 630 003, Tamil Nadu, India
ENTREPRENEURSHIP, INNOVATION AND CAREER HUB

World Entrepreneurs Day
21st August 2021

**Upskilling and Reskilling -
The Future of Entrepreneurship**

21st August 2021
SUNDAY
02:00 PM - 04:00 PM

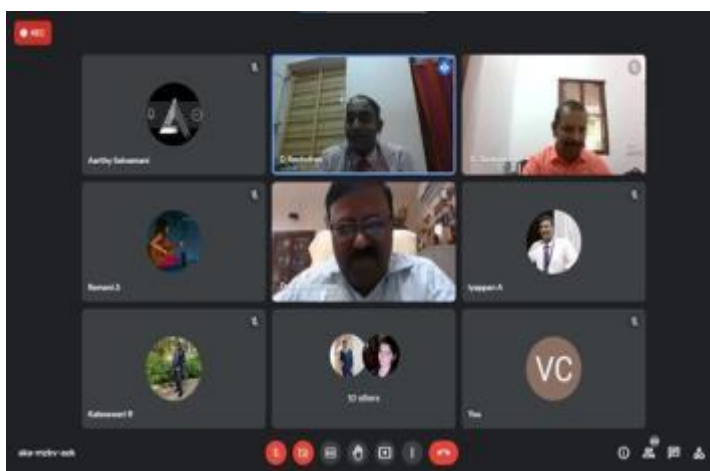
Google Meet
aka-mzkv-aek

DR. D. RAVINDRAN
Assistant Professor - School of Management,
Innovation Activity Coordinator (IAC),
KJ Somaiya Institute of Management, Bangalore, Karnataka

Dr. G. Ilankumaran
Chairman - IC, ALU &
Director (I) - IIC Hub

Prof. S. Rajamohan
Senior Professor and Director, IIC

Prof. C. Sekar
Vice - President, IC, ALU &
Registrar (I/C)




ALAGAPPA UNIVERSITY
(A State University Established in 1985)
KARAIKUDI - 630 003, Tamil Nadu, India
www.alagappainnovation.ac.in

ENTREPRENEURSHIP, INNOVATION AND CAREER HUB

INSTITUTION'S INNOVATION COUNCIL
ALAGAPPA UNIVERSITY (IIC-ALU)

World Entrepreneurs Day
24th August - 24th August 2021

Panel Discussion
**Startup Opportunities for
Aspiring Entrepreneurs**
24th August 2021 @ 2.30 PM

Dr. G. Ilankumaran
Chairman - IC, ALU &
Director (I) - IIC Hub

Google Meet
aka-mzkv-aek

Dr. A. Iyappan
Moderator
Student - Level Startup Coordinator, IC, ALU
ICSR Prof. - Founding Partner, Alagappa Institute of Management

Mr. S. Rajesh Kumar
CEO - S. R Digital Media & Services

Mr. Siva Subramanian S., M.B.A.,
Field Developer - IASCI - IISIP PA, Tiruchirappalli

S. J. Whelan
S.J. (First Aged 1968 - 2020 Whelan)
CEO of WENSMAN

M. Sangeetha Sarav (M.B.A)
Member of TUGL 1983
Founder - SaaS DevOps Team Bangalore

Prof. C. Sekar
Vice - President, IC, ALU &
Registrar (I/C)

Break through Innovations / Technology Developed

- Students and Trainers of EIC Hub have designed and developed the following innovative devices with the focus of COVID-19 preventive measures



Sensor based Touch-free Sanitizer Dispenser
(June 2020)



**Cost effective UV-based Air Disinfectant for
Air Conditioner Systems (September 2020)**



**Mechanical Cylinder and Piston based Toilet Liquid Sanitizer
Dispenser (February 2021)**

Participation of IIC-institute in various programs of Central and State Govt. Highlighting specially for the schemes or programs

ARIIA – participation and Rank

- First time participation in ARIIA
- Rank : Yet to declare

Implementation of NISP

Activities Completed:

- Enrolled in NISP
- Nomination of Coordinator : May 2021
- Formation of Expert Committee for Policy framework
- Formation of Institute level implementation committee
- Active participation of IIC in implementing NISP

State Government Schemes

- Created Innovation and **Entrepreneurship Development Programme Hub (IEDP Hub)** of Entrepreneurship Development And Innovation Institute (EDII-TN) for coordinating Innovation and Entrepreneurship activities of University Departments and Affiliated Colleges

IIC Calendar Year (2020-21)



Contact us

Dr. C. Sekar

Registrar i/c, Alagappa University

Vice-President

Dr. G. Ilankumaran

Director i/c, AISD, Alagappa University

Convener



04565-224225



iic@alagappauniversity.ac.in

Follow us on Social Media



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@iic_alu



iicalu



<https://www.facebook.com/iicalu>

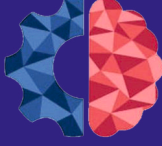


https://twitter.com/iic_alu



https://www.instagram.com/iic_alu/

*Institution Innovation Awards
& Achievements*



INNOVATION CELL
(Government of India)



Ministry of Education
(Government of India)



**ATAL RANKING OF INSTITUTIONS
ON INNOVATION ACHIEVEMENTS**

Certificate of Recognition

This is to certify that

ALAGAPPA UNIVERSITY

is recognised in the band "PERFORMER" under the category
"General (Non-Technical)"

in Atal Ranking of Institutions on Innovation Achievement (ARIIA) 2021,
a flagship program of the Ministry of Education, Government of India.

29th December 2021.

Dr. Anil D Sahasrabudhe
Chairman, AICTE

Shri K Sanjay Murthy
Secretary (HE), MoE

Dr. Abhay Jere
Chief Innovation Officer
MoE's Innovation Cell



Ministry of Education
Government of India



Certificate

NATIONAL INSTITUTIONAL RANKING FRAMEWORK

INDIA RANKINGS 2023

**Alagappa University Karaikudi
Ranked 43 in Research Institutions Category**

CHAIRMAN, NBA

MEMBER SECRETARY, NBA

Innovative Funds

**GOVERNMENT OF TAMIL NADU
DEPARTMENT OF ARCHAEOLOGY**

From
Dr. R. Sivanantham.,
Commissioner [Full Addl. Charge],
Department of Archaeology,
Tamil ValarachiValaagam,
ThamizhSalai, Egmore,
Chennai - 600 008
e-mail : tnarch@nic.in
tnarchcommissioner@gmail.com

To
Prof. C. Sekar,
Registrar (i/c),
Alagappa University,
Alagappapuram,
Karaikudi - 630 003
Sivagangai District

Lr.No. D3/1204/2022-2, dated: 31.03.2022

Sub : Department of Archaeology - 2021-2022 -
Alagappa University - Excavation at
Ellanthakarai and its surrounding of Kalaiyarkoil
taluk in Sivaganga District - seeking financial
assistance for a sum of Rs. 15 Lakhs -
requesting revised proposal for a grant of Rs. 5
lakhs - Intimation - Regarding.

Ref : 1) G.O. 192, Tourism, Culture and Religious
Endowment Department, dt. 29.11.2021
2) Registrar (i/c), Alagappa University,
Karaikudi, Ref : AU: S.O. (P&D) :
Excavation at Ellanthakarai: 2022. dated
21.03.2022.

* * * * *

As per your request seeking financial assistance of Rs. 15 Lakh for the proposed excavation at Ellanthakarai and its surroundings of Kalaiyarkoil taluk in Sivaganga District under the direction of Dr.S.Rajavelu, Adjunct Faculty, History Department as a Director of the excavation and Dr. A.R. Saravanakumar, Head (i/c) of the Department of History, Alagappa University, as co-director of excavation vide letter cited (2), an amount of Rs.5,00,000/- has been approved within the rules and regulations and subject to the following conditions:

1. The grant is approved for the said excavation programme as per the rules and regulations as specified and subject to the availability of the fund under the specific head.
2. The fund is approved to the tune of 75% of the total expenditure or less, whichever is applicable, subject to the availability of the fund. The 25% of the matching grant needs to be borne by the Institution.
3. The permission letter of the Archaeological Survey of India to undertake the said excavation program for the said season has to be submitted.
4. The fund shall be utilized only for the excavation related expenses including scientific dates/analysis/report writing and any other post-excavation analysis.
5. The preliminary Excavation Report must be submitted to ASI and TNSDA within one year from the date of completion of the excavations. The final report must be submitted to ASI and TNSDA within three years from the date of completion of the excavations or as per the norms of the Excavation and Exploration policy of the Archaeological Survey of India from time to time.
6. The **original vouchers/invoices/bills/receipts** must be submitted within three months or within the financial year, whichever is earlier, along with a head wise statement of expenditure and the Utilization certificate for the released grant.
7. The grant would be released to the Head of the institutions at the appropriate time preferably two weeks before the date of the commencement of the excavations subject to the acceptance of the above said conditions.

It is hereby requested to submit the acceptance letter, the likely date of commencement of the excavation and also the revised head wise budget proposal (i.e., 75% TNSDA and 25% Institution) of the approved amount.

It is further stated that you are requested to provide the bank details of the Institution account for E-transfer.


/ By Order /

Sd/-
Commissioner [FAC]


Assistant Director (H.Q.)

Copy to

1. Dr. S. Rajavelu
Adjunct Faculty
History Department
Alagappa University
Alagappapuram
Karaikudi - 630 003
2. Dr. A.R. Saravanakumar
Head (i/c) of the Department
History Department
Alagappa University
Alagappapuram
Karaikudi - 630 003


31.3.2022.



सत्यमेव जयते

No. I-19011/63/2022-DMEO
Government of India
NITI Aayog
Development Monitoring and Evaluation Office
(Administration Division)

15th
Dated: 12th May, 2023

Subject: Letter of Award (LOA) for "Monitoring and Evaluation Capacity Building of Universities" in the State of Tamil Nadu-reg.

Sir/Madam,

This is in response to your "Expression of Interest" received, vide letter dated 21.10.2022, regarding "Monitoring and Evaluation Capacity Building of Universities" in the State of Tamil Nadu. After evaluating your proposal, DME0 is pleased to inform you that your University has been selected for the study in the state of Tamil Nadu. The total cost of the project shall be ₹ 1,97,318/- (One Lakh Ninety-Seven Thousand Three Hundred and Eighteen Rupees only).

2. The scope of work is given at Annexure A and the terms and conditions for the study is given at the Annexure B. You are requested to kindly sign and return two sets of Letter of Award (LOA) to DME0, NITI Aayog in acknowledgement and acceptance of the LOA, within 7 (seven) days of receipt.

3. The study shall commence from the date of the receipt of acceptance of LoA by DME0.

(Jayanta Kumar Patel)
Economic Officer (Admin)/HoO
431, 4th Floor, NITI Aayog
011-23096799

To
Prof. S. Rajamohan, Registrar
Alagappa University, Karaikudi, Sivaganga
Email: registrar@alagappauniversity.ac.in

Name of the Department : Social Work
 Duration : one year
 7. Budget Estimation

Sl. No	Expenditure Head	Amount (Rs. Lakhs)		
		100%	60%	40%
1	Project Personal Research Associate (1 Nos) $1 \times 16000 \times 12 = 1,92,000$ Field Investigators (3 Nos) $3 \times 10000 \times 3 = 90,000$	2,82,000	1,69,200	1,12,800
2	Travel / Field Visit, Data Collection, Data analysis / Logistics / Boarding and Lodging	1,00,000	60,000	40,000
3	Equipment and Study Materials: Computer, Printer, Source Material / Software and Data set, CD / AV sources, etc.,	1,00,000	60,000	40,000
4	Publication Expenses including Report Preparation, Final report submission, Publication of research papers, Books, etc.,	18,000	10,800	7,200
5	Incentive Schemes for Patent and High Citation in Scopus / Indexed Journals	-	-	-
6	Contingency	-	-	-
Total		5,00,000	3,00,000	2,00,000

Approved.

D. Rale...
 01/12/22

RUSA COORDINATOR
 ALAGAPPA UNIVERSITY
 KARAIKUDI

30/11/22
 30/11/22

Nimish Kapoor

Scientist E

Email: nkapoor@vigyanprasar.gov.in, nimish.vp@gmail.com

M: +91 9810215648; +91 120 2404430, 2404435 (Extn: 109)

VP/SSFD/1446/Int. Radio/2021

6th July 2021

Prof. B. Vaseeharan

Registrar i/c

Alagappa University

Vallal Alagappan Valagam

Karaikudi-630003

Tamil Nadu

Sub: Sanction order regarding the Science and Health communication through Internet Radio / Podcasts for Senior citizen communities

Dear Prof. Vaseeharan,

This is to inform you that competent authority of Vigyan Prasar has sanctioned a budget of Rs. 2496000/- [Twenty-Four Lakh Ninety Six Thousand only] for the collaborative project of Vigyan Prasar and Alagappa University, Karaikudi, Tamil Nadu - The Science and Health communication through Internet Radio / Podcasts for Senior citizen communities from six podcast stations.

2. Details of the sanctioned budget are given below:

Head	Rate and quantity	Total amount in Rs.
Programme production at Rs. 4000/- per episode [104 programmes per station, per year* x 6 station =624 programme] *2 episodes per week x 52 weeks = 104 programmes	Rs. 4000/- x 624 programme	24,96,000/-
Total		24,96,000/-

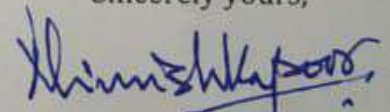
(2)

2. 80% of the total approved budget i.e Rs.19,96,800/- (Nineteen lakhs, Ninety-Six Thousand and Eight Hundred only) has been transferred through ECS on 2nd July 2021 to the bank account of Alagappa University, Karaikudi, Tamil Nadu. Remaining (20%) amount will be released after the completion of the programme, and submission of utilization certificate (UC) and statement of expenditure (SE).

The other terms & conditions in this regard are as follows:-

1. Since, it is being the collaborative programme, the VP will be kept informed about the progress of the project through **monthly reports** along with the following documents:
 - a. Press clippings and electronic media broadcast
 - b. Publicity through digital and social media
 - c. Photographs of the programme production / recording
 - d. Feedback of the listeners
2. The duration of the project is one year from the date of the issue of the sanctioned letter. Extension of the project if any required will be considered only in compelling circumstances. This extension will however be without any additional budget.
3. You are requested to submit the SE & UC (provisional) in original on the closure of financial year/s and final SE & UC after completion of the programme.
4. All 624 programmes should be unique and new programme. Repeat telecasts will not be counted for reimbursement.
5. The wide publicity of the programme should be given in the local media, softcopies of media clippings, electronic media broadcast and proof of the same may be included in the monthly reports.
6. You are requested to maintain a separate account for this programme. Any interest earned should be reflected in the SE & UCs, as same will be treated as credit, to be adjusted towards further installments.
7. In case no interest is earned, same need to be mentioned specifically in the SE & UC.

Sincerely yours,



Nimish Kapoor



M.P. Madhukar
Deputy Director
In-Charge-TCB Division
Tel: 26742832
Email: madhukar806@gmail.com



Indian Council of Social Science Research
(Ministry of Education)
Post Box No. 10528, Aruna Asaf Ali Marg
New Delhi - 110067
EPABX: 26741849-51 Fax: 91-11-26741836
Website: www.icssr.org

F. No. 5-19/RMC/GEN/2021-22/TCB

Dated: 02.12.2021

The Registrar
Alagappa University
Karaikudi- 630003
Tamil Nadu

Sanction Order

Subject: Sanction of ICSSR for organising Ten Days Research Methodology Course for M. Phil/Ph.D./PDF scholars in Social Sciences from 03rd -12th January 2022 to Prof. K. R. Murugan, (Course Director), Dept. of Social Work and Dr. N.K. Bhuvanewari (Co-Course Director), Dept. of Politics and Public Administration, Alagappa University, Karaikudi, Tamil Nadu.

We are happy to convey that the ICSSR, New Delhi has approved the proposal received from Prof. K. R. Murugan, (Course Director), for organizing above mentioned programme **ten days RMC through offline mode** and sanctioned an amount of Rs. 5,50,000/- (Rupees Five Lakh Fifty Thousand only) for this programme.

1. The sanctioned Grant-in-Aid of Rs. 5,50,000/- will be released in two instalments:

a. 1st instalment: Rs. 4,00,000/-
b. 2nd & final instalment: Rs. 1,50,000/-

Grand Total Rs. 5,50,000/-

The 1st instalment of Rs. 4,00,000/- will be released on the receipt of an advance **Grant-in-Aid bill** (copy enclosed) duly signed and stamped by the Competent Authority.

2. The 2nd & final instalment will be released after the receipt of the following:

- Final programme report including observations/recommendations by the Resource Persons.
- Course outlines.
- One set of study material.
- Summary of evaluation by the participants.
- An audited Statement of Accounts and Utilization Certificate in **GFR 12-A** form for the entire sanctioned amount duly signed by the Competent Authority and Chartered Accountant.

3. The Course Director of the Programme will be Prof. K. R. Murugan and Dr. N.K. Bhuvaneshwari, will be Co-Course Director. Prof. Murugan will be responsible for successful conduction of the programme.
4. **The Course Director is required to strictly follow the terms and conditions including the budget allocation as clearly mentioned in the ICSSR TCB guidelines which are available at the ICSSR website www.icssr.org (copy of budget enclosed)**
5. The institution may re-appropriate expenditure form one sanctioned sub-head to another subject to a maximum of 10 percent. All such re-appropriations should be reported to the ICSSR. Proposals for appropriations, which exceed 10 per cent of the amount sanctioned for any item shall require the prior approval of the ICSSR.
6. The amount of grant sanctioned herein is to be utilized by stipulated period. Any amount of the grant remaining unspent during this period shall be refunded to the ICSSR immediately after completion of the programme along with the simple statement of expenditure. If the Grantee fails to utilize the grant, it will be refunded to the ICSSR with interest thereon @ 10% p.a. from the date of its sanction.

(M.P. Madhukar)
For Member-Secretary

Copy to:

1. Prof. K. R. Murugan (Course Director)
Dean-Faculty of Arts
Dept. of Social Work
Alagappa University
Karaikudi- 630003, Tamil Nadu
2. Dr. N.K. Bhuvaneshwari (Co-Course Director)
Adjunct Faculty
Dept. of Politics and Public Administration
Alagappa University
Karaikudi- 630003, Tamil Nadu
3. FA & CAO, ICSSR, New Delhi. The expenditure is debitable to the Budget Head: D-001, Training on Research Methodology (Plan-GEN). **Scheme code- 0877**

(M.P. Madhukar)
For Member-Secretary

Budget Allocation for RMC

Course Coordinator _____

Name of the Institution _____

Date of programme _____

Duration (Day): 10 working days

S. No.	Expenditure Head	No.	Unit Cost (Rs.)	Maximum Limit (In Rs.)
1.	Travel Outside the state Resource Persons (5 within & 5 outside the state)	10	--	1,15,000/-
	ICSSR Observer (s) Participants (10 within & 10 outside the state)	20		20,000/-
2.	Honorarium Outside the state Resource Persons per session (5x2=10x3000= 30000/-)		3000/ per session	30,000/-
	Within the state Resource Persons per session(5x2=10x3000= 30000/-)		3000/ per session	30,000/-
	Local Resource Persons per session (5x2= 10x2500= 25,000/-)		2,500/ per session	25,000/-
	Course Director		1000/ per day	10,000/-
	Co-Course Director		500/ per day	5,000/-
3.	Stay Costs Outstation Resource Persons Participants			1,00,000/-
4.	Food charges (Rs.500 per day, per person)			1,50,000/-
5.	Course material			15,000/-
6.	Field work			20,000/-
7.	Contingency (including paper, stationary, photocopying, advertisement costs etc.	--	--	20,000/-
8.	Overhead charges payable to organising institution		--	10,000/-
	TOTAL			5,50,000/-

*The duration of each session is one and half hour (90 Minutes). Number of sessions 30**. The total Resource Persons from outside the state can be 5, from the state can be 5 & local Resource Persons can be 5 to 8. Resource Persons from outside the state and from the state will be assigned two (2) sessions each, while local Resource Persons may be assigned 1 to 2 session/s subject to a maximum limit of 10 lectures in all the three categories.*

M. J. ...

Format for Audit Statement of Accounts for Research Methodology Course

Course Coordinator _____

Name of the Institution _____

Date of Programme: _____

S. No.	Expenditure Head	Allocation (In Rs.)	Expenditure (in Rs.)
1.	Travel Outside the state Resource Persons (5 within & 5 outside the state) ICSSR Observer (s) Participants (10 within & 10 outside the state)	1,15,000/- 20,000/-	
2.	Honorarium Outside the state Resource Persons per session (5x2=10x3000= 30000/-) Within the state Resource Persons per session (5x2=10x3000= 30000/-) Local Resource Persons per session (5x2= 10x2500= 25,000/-)	30,000/- 30,000/- 25,000/-	
	Course Director	10,000/-	
	Co-Course Director	5,000/-	
3.	Stay Costs Outstation Resource Persons Participants	1,00,000/-	
4.	Food charges (Rs.500 per day, per person)	1,50,000/-	
5.	Course material	15,000/-	
6.	Field work	20,000/-	
7.	Contingency (including paper, stationary, photocopying, advertisement costs etc.	20,000/-	
8.	Overhead charges payable to organising institution	10,000/-	
	TOTAL	5,50,000/-	

Signature/Stamped

Finance officer

Registrar

Chartered Accountant

Course Director



भारत सरकार
राष्ट्रीय महिला आयोग
प्लाट नं. 21, जसोला इंस्टीट्यूशनल एरिया,
नई दिल्ली-110025
GOVERNMENT OF INDIA
NATIONAL COMMISSION FOR WOMEN
PLOT NO. 21, JASOLA INSTITUTIONAL AREA,
NEW DELHI-110025
Website : www.ncw.nic.in
Date: 23/12/2021

File No: 16(296)/2021-22/NCW (SCW)

To,

Dr. K.R. Murugan
Professor and Head, Department of Social Work
Alagappa University
Karaikudi, Shivaganga
Tamil Nadu 630003

Subject: Seminar on "Identification of Abusive Relationships and Prevention of Domestic Violence"

Madam/Sir,

Please refer to the proposal submitted by you to the National Commission for Women for organising **Seminar** on the above mentioned subject. I am happy to inform you that the Commission has approved your proposal for conducting **Seminar** with a financial assistance restricted to **Rs. 1,50,000/- (Rupees One Lakh Fifty Thousand only)**.

2. In order to enable the Commission to process the matter further, following documents/information are required to be made available to the Commission as per prescribed formats within 10 days (05 days via email) of the issue of this letter which has also been emailed to you:

- I. Acceptance Letter
- II. Undertaking in the prescribed format (**Annexure-A**)
- III. Details for linking of PFMS with NCW in the prescribed format (**Annexure-B**)
- IV. Bank Mandate Form in the prescribed format (**Annexure-C**)

3. The sanctioned amount shall be released in two instalments as under:

- I. 50% in advance after acceptance of the proposal along with requisite documents (as mentioned in **Para No.2**)
- II. The balance 50% on receipt of the satisfactory webinar report in the prescribed format (as described in **Para No.5**) and on submission of the following documents:

- A. Utilisation Certificate (As per GFR 12-A)
- B. Item wise Expenditure Statement

C. Original Bills and Vouchers

4. It may be noted that the first instalment will be released only after receipt of the documents/information as mentioned in **Para No.2**. If no response is received within 15 days of the issue of this letter, the approval will be deemed to be cancelled.

5. It may be noted that the sanction may be rejected and amount released may be recovered any time in case, the grantee organisation fails to conduct the **Seminar** or fails to submit the satisfactory **Seminar** report including the following details:

- I. Detailed session wise summary of the proceedings of the **Seminar**
- II. Gist of deliberations made/information shared by the Resource Persons
- III. Specific, actionable and topic oriented recommendations bifurcated into actionable at Local, State and Central Government levels.
- IV. Full recording of the **Seminar**
- V. List of Participants with their names, addresses, contact number and email addresses
- VI. List of Resource Persons along with their designation and contact details (At least 60% Resource Person as mentioned in the webinar proposal must participate in the webinar)

6. Commission shall depute an officer/observer to ensure adherence with the stipulated guidelines and presence of the qualified resource persons. **The Seminar must be organised on 30th January, 2022 mandatorily.**


7. It may also be noted that it may take at least one month to release the first instalment after receipt of the requisite information/documents from you.

8. Please quote the reference number of this letter in future correspondence and also ensure that the organisation is registered under PFMS and linked with NCW, otherwise payment cannot be made.

9. For further details you may send an email to sro-ncw@gov.in

Encl: As Above

Yours faithfully,


(Ashutosh Pande)
Sr. Research Officer



ज्ञान-विज्ञान विमुक्तये

डॉ. शकील अहमद
संयुक्त सचिव

Dr. Shakeel Ahmad
Joint Secretary



सत्यमेव जयते

विश्वविद्यालय अनुदान आयोग
University Grants Commission

(मानव संसाधन विकास मंत्रालय, भारत सरकार)
(Ministry of Human Resource Development, Govt. of India)

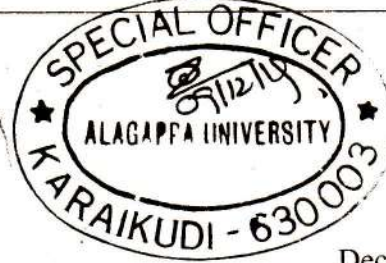
बहादुर शाह जफर मार्ग, नई दिल्ली-110002
Bahadur Shah Zafar Marg, New Delhi-110002

दूरभाष Phone : 011-23232055

ई-मेल E-mail : shakeel.ugc@nic.in

No. F. 2-5/2019 (STRIDE-I)

The Vice-Chancellor
Alagappa University,
College Road, Alagappa Puram,
Karaikudi, Tamil Nadu - 630003



December, 2019

Subject: UGC Assistance for Component-1 (Research Capacity Building and Human Resource Development) under STRIDE - (Duration - 3 Years).

Sir/Madam,

1. This is with reference to the proposal submitted by Alagappa University to support for Component-1 (Research Capacity Building and Human Resource Development) under Scheme for Trans-disciplinary Research for India's Developing Economy (STRIDE) of the University Grants Commission (UGC).
2. On the basis of the recommendations of the Expert Committee at its Interface Meeting held on 26th and 27th November, 2019, I am directed to convey approval of the UGC for the proposal submitted by the University under Component-1 (Research Capacity Building and Human Resource Development) under the STRIDE (duration of 3 years from the date of receipt of first instalment) with the following identified approaches:
 - a) Curriculum
 - b) Critical Thinking
 - c) Faculty Resources
 - d) Criteria of Selection
 - e) Training Strategies
 - f) Training Methods
 - g) Innovations
 - h) Implementation Process (time-frame)

The Coordinator of the Project shall be responsible for implementation of the Project as per the identified approaches under the overall supervision of the Vice-Chancellor. He/She may continue till the end of the project or till his/her superannuation.

3. The financial assistance approved for implementing the present project for a duration of 3 years is given below :-

S. No.	Non-Recurring (Items)	Rs. (In Lakh)
1.	Equipments:	16.0
2.	Upgradation/augmentation extension of existing laboratory for housing and installation of new equipment including air-conditioning	-
	TOTAL	16.0
S. No.	Recurring(Items)	
1.	Core Assistance (Participant Cost and Hiring Services)	43.0
2.	Human Resources (Subject Experts) Cost	22.0
3.	Contingencies (Utilities, Stationary and Miscellaneous)	9.0
4.	Travel (Domestic and International)	10.0
	TOTAL	84.0
	Grand Total(NR+R)	100.0

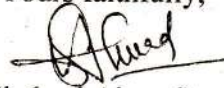
Amount in words: Rupees One Crore Only.

4. The University is requested to take immediate steps to submit the following documents for necessary action:
- Acceptance of the terms and conditions of the grants duly signed by the Registrar of the University.
 - Name of the competent University Officer with full address and other bank details in (mandate form) the prescribed enclosed proforma so that the fund can be transferred electronically.
 - A Certificate from the Registrar of the University that it is eligible to receive the UGC financial assistance.
5. The first installment of admissible grant will be released only on the receipt of requisite documents requested vide para 4 by return of post.
6. The University is required to maintain a separate flexi saving bank account for the grants released for Component-1 (Research Capacity Building and Human Resource Development) under STRIDE. Interest earned against Grant-in-aid (other than reimbursement) released to any grantee institution should be mandatory remitted to the UGC account immediately after finalization of account. Any interest earned out of Grant-in-aid should not be allowed as additional funds over and above the allocation.
7. The University shall constitute immediately a Mentoring and Monitoring Committee (MMC) as per the STRIDE guidelines which can be downloaded from UGC's website ww.ugc.ac.in and follow the terms of reference of the Mentoring and Monitoring Committee (MMC) to ensure effective implementation and monitoring of the Project.




8. The task of purchasing of equipments and upgradation/augmentation/extensions of existing laboratory for housing and installation of new equipment including air-conditioning, if any, should be completed within a year from the date of receipt of the grant by the University. It may be noted that if it is not done within a year from the date of receipt of the grant by the University, the approval shall be considered as lapsed.
9. No request for any change in the effective date of the implementation of the Project will be considered.
10. The second/subsequent installment of grant for any approved items will be considered and sanctioned only on the receipt of the year-wise & item-wise Utilization Certificate along with annual progress report for the earlier installment in the prescribed form duly signed by the Registrar/Principal/Finance Officer as the case may be.
11. The annual progress report shall be submitted as per the Guidelines of STRIDE.
12. The University shall include all existing conditions also communicated from time to time by UGC in the Utilization Certificate, in respect of any financial assistance or grants-in-aid to any institution under any of the general or special schemes of the UGC.
13. The University shall take all possible measures to ensure effective implementation of policies and general financial rules of Government of India.
14. This approval is subject to the fulfillment of condition of inclusion of the University under section 2(f) and 12(B) of UGC Act, 1956 or any policy decision in this regard.
15. The University shall strictly follow the STRIDE Guidelines posted on UGC website.
16. The Project will be withdrawn at any point of time if it is found that the institution is ineligible or grant is not utilized for the purpose which it has been sanctioned or UGC rules have not been followed for utilizing the grant.

Yours faithfully,


(Dr. Shakeel Ahmad)
Joint Secretary (STRIDE)

Copy to:

1. The Coordinator of the Project, Alagappa University, Karaikudi, Tamil Nadu - 630003.
2. The Secretary (Higher Education), Chennai, Tamil Nadu.
3. The Joint Secretary (Regional Office), SERO, Hyderabad - 500001 (A.P).
4. Guard File.


(Nirmal Kaur)
Under Secretary



Incubation and Technology Transfer Center

(A State University Accredited by NAAC with 'A' Grade)

Karaikudi - 630 003, INDIA

Prof. K. BALAMURUGAN

Coordinator

Tel: + 91 4565 223322

Email: bsuryar@yahoo.com

www.alagappauniversity.ac.in

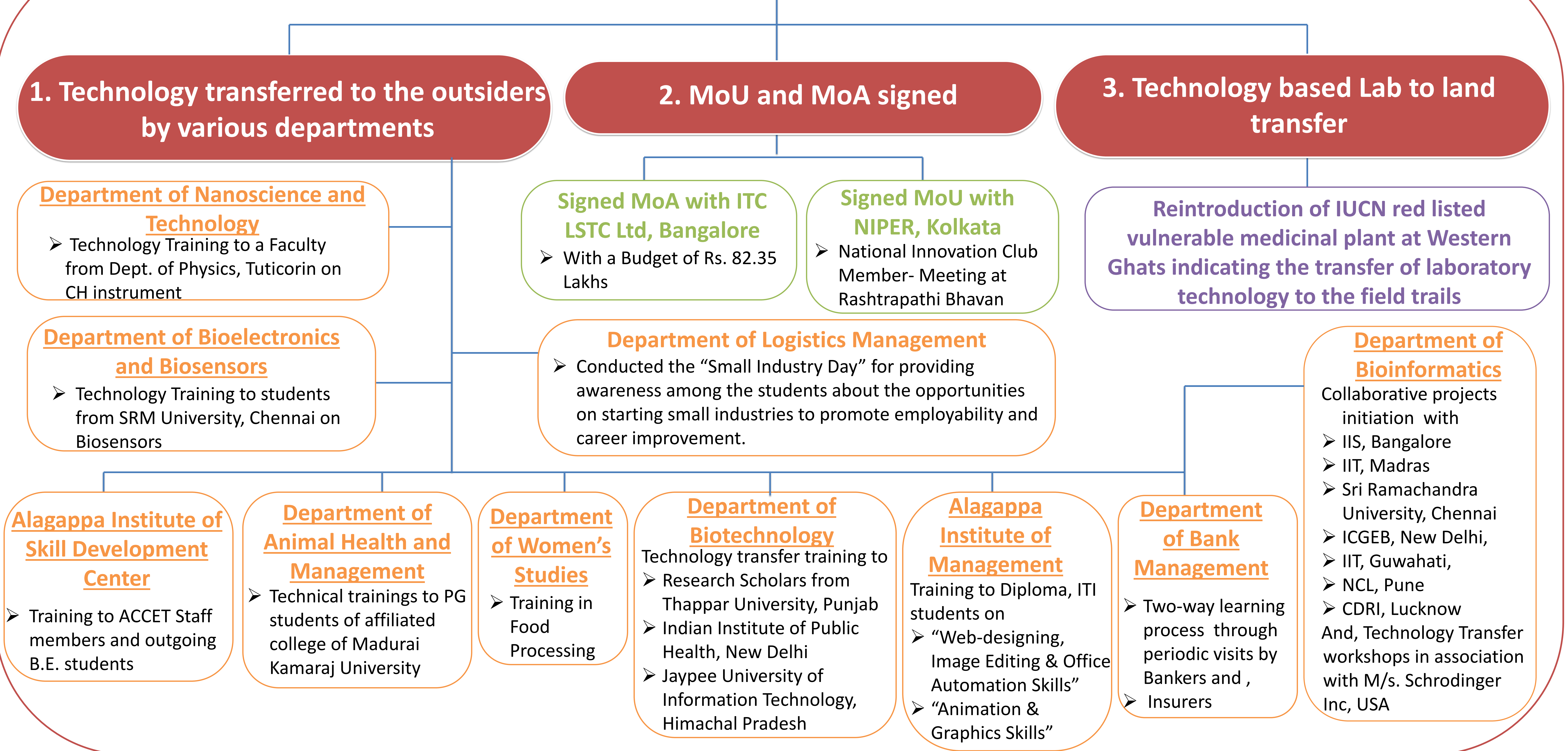
AIM:

- ✓ To provide an effective and facilitating bridge between Alagappa University's Research Laboratories/Facilities and National Research Institutes/Industry
- ✓ To provide technical Expertise/Skills/Guidance

OBJECTIVES:

- ✓ Optimizing Technological Research projects for facilitating collaborative projects
- ✓ Access/Services to common facilities within the University
- ✓ Innovative problem solving consultancy with Industry
- ✓ Support services for start-up companies for a stipulated period
- ✓ Technology transfer trainings at the Specialized facilities

RANGE OF ACTIVITIES



Innovative EIR Projects

LIST OF INCUBATION – FACULTIES EIR PROJECTS

Sl. No	Name of the Department	Principal Investigator	Co P.I.	Project Title	Amount
1.	Animal Health and Management	Prof.B. Vaseeharan Professor and Head	Dr.N.M.Parbhu Assistant Professor	Evaluation and commercialization of collagen based ZnO curcumin incorporated smart wound dressing device for wound healing.	497000
2.	Microbiology	Dr.T.Kavitha Assistant Professor	Dr.A.Arun Professor and Head	Biochar Based inoculum development for sustainable agriculture	225000
3.	Bioinformatics	Dr.M.Karthikeyan Assistant Professor	Dr.N.M.Prabhu Assistant Professor	Nutrigenomics and Computational Prospective studies on Parkinson Disease.	200000
4	Animal Health and Management	Dr.N.M.Prabhu Assistant Professor	Dr.S.Palanisamy Research Professor Dr.B.Vaseeharan Professor and Head	Standardization of isolation techniques for commercial production of fucoidan and investigation of their biological activities.	322500
5	Biotechnology (DDE)	Dr.P.Rameshthangam Assistant Professor	---	Microbial production of high purity prebiotic isomalto – oligosaccharides.	355000
6	Biotechnology	Dr.S.Gowrishankar Assistant Professor	Nil	Development of pathoblockers based topical formulations and pre-clinical evaluation against VVV-BV mixed vaginitis: a beginning towards antivirulence drug commercialization	195750
7	Biotechnology	Dr.K.Balamurugan Prof. and Head	Muthubharathi B C Ph.D. scholar	Development/ Fabrication of bio-detector for biological sample analysis in the microfluidic platform	329250
8	Animal Health and Management	Dr.V.Nithya Assistant Professor	----	Diversification of dairy farming in rural areas of Tamil Nadu by promoting sustainable value-added products of Polyunsaturated fatty acids from cow milk.	187500
9	Biotechnology	Dr.K.Pandimadevi Professor	Dr.S.Aravindh Executive Director & CSO	Eco -friendly Herbal Pesticide formulation Against Mealy Bugs	375000
10	Animal Health and Management	Dr.P.Kumar Assistant Professor	-	Development of silica based nanotheranostics targeting breast cancer	128250
11	Bioelectronics and Biosensors	Dr.V.Dharuman Assistant Professor	Dr.J.Mathiyarasu Senior Scientist Central Electrochemical research institute	Cost effective renewable diabetic sensor for home and personal care	355000
12	Bioelectronics & Biosensor	Dr.C.Sekar Professor and Head	Dr.A.Rathinavel Dean Madurai Medical College and Hospital	An Electrochemical Sensor for Early Non-Invasive Diagnosis of Hepatic Disorders.	500000
13	Industrial Chemistry	S.Viswanathan Assistant Professor	S.Karuppuchamy Prof. and Head	Solar- Powered Electrochemical Technologies for Textile wastewater Treatment	289500
14	Nano Science and	Dr.P.Shakkthivel	Chandrasekaran	A Compact Flow Capacitor	362500

LIST OF INCUBATION – FACULTIES EIR PROJECTS

	Technology	Piraman Professor	Ramasamy Alumni	Analysis Using Gel Electrolytes for future Energy storage Devices.	
15	Nano Science and Technology	Dr.P.Shakkthivel Professor	-----	Developing Holistic Infrastructure of high voltage solid state Li-Ion Battery For Electric Mobility Applications.	500000
16	Bioelectronics and Biosensors	Dr.J.Wilson Assistant Professor	S. Girija Ph.D., Research Scholar	Temporary tattoo based electrochemical biosensor for health care	700000
17	Library and Information Science	Dr.S.Thanuskodi Professor &Head	Dr.S.Kishore Kumar Deputy Librarian	Current Research Information System for Tamil Nadu	350000
18.	Microbiology	Dr. A. Arun Professor & Head	Dr. R. Yuvakkumar Assistant Professor Dr. R. Swaminathan Industry Partner	Waste to energy: Large scale Sewage Treatment Plant (STP) and production of green hydrogen and Biotechnology using an innovative process	42,00,000
Total					1,00,72,250

	ALAGAPPA UNIVERSITY (A State University Established by the Government of Tamil Nadu in 1985, Accredited with A+ Grade by NAAC (CGPA 3.64) in the Third Cycle, Graded as Category-I University and Granted Autonomy by MHRD-UGC, MHRD-NIRF 2020 Rank : 36, QS 2020 India Rank : 24) KARAIKUDI - 630 003, Tamil Nadu, India	
Phone: (+91) 4565 223253	E-mail: rusa.alucoordinator@alagappauniversity.ac.in	

Rc.Alu/RUSA 2.0 / EIR /2023

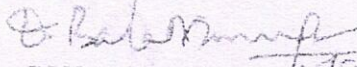
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Animal Health and Management
Principal Investigator (PI)	Prof.B.Vaseeharan Professor and Head
Co-Investigator (Co-PI)	Dr.N.M.Parbhu Assistant Professor
Title of the Project	Evaluation and commercialization of collagen based ZnO curcumin incorporated smart wound dressing device for wound healing.
Project Duration	12
First Installment (for the first three months project duration)	Rs.4,97,000/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
2. All the request letters / purchases should be routed through the Program Officer, EIC Hub, Alagappa University for taking further action.
3. The PI/ Co-PI has to submit the progress (Process / Product / Prototype etc.) made after three months, i.e.,15/5/2023. The Expert Committee will evaluate the progress and based on the comments / recommendations, the tenure of the project will be extended.
4. Only one quarter of the budget approved is sanctioned as the first instalment and the remaining grant will be sanctioned based on the Expect Committee's recommendation.
5. The Product / Prototype / Process shall solely belong to Alagappa University and the rights whatsoever arising there from shall be with Alagappa University.


 RUSA Co-ordinator / 15/2/23
 15/2/23 SP
 15/2/23

To.

Principal Investigator / Co-PI

	<h2>ALAGAPPA UNIVERSITY</h2> <p>(A State University Established by the Government of Tamil Nadu in 1985, Accredited with A+ Grade by NAAC (CGPA 3.64) in the Third Cycle, Graded as Category-I University and Granted Autonomy by MHRD-UGC, MHRD-NIRF 2020 Rank : 36, QS 2020 India Rank : 24)</p> <p>KARAIKUDI - 630 003, Tamil Nadu, India</p>	
	<p>Phone: (+91) 4565 223253</p>	

Rc.Alu/RUSA 2.0 / EIR /2023

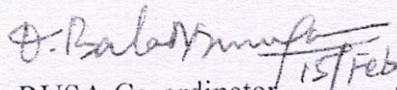
15.02.2023



**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Microbiology
Principal Investigator (PI)	Dr.T.Kavitha Assistant Professor
Co-Investigator (Co-PI)	Dr.A.Arun Professor and Head
Title of the Project	Biochar Based inoculum development for sustainable agriculture
Project Duration	12
First Installment (for the first three months project duration)	Rs.2,25,000/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
2. All the request letters / purchases should be routed through the Program Officer, EIC Hub, Alagappa University for taking further action.
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 RUSA Co-ordinator. 15/2/23

 15/2/23
 15/2/23

To.

Principal Investigator / Co-PI

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Phone: (+91) 4565 223253	E-mail: rusa.alucoordinator@alagappauniversty.ac.in	

Re:Alu/RUSA 2.0 / EIR /2023

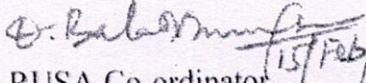
15.02.2023


**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Bioinformatics
Principal Investigator (PI)	Dr.M.Karthikeyan Assistant Professor
Co-Investigator (Co-PI)	Dr.N.M.Prabhu Assistant Professor
Title of the Project	Nutrigenomics and Computational Prospective studies on Parkinson Disease.
Project Duration	12
First Installment (for the first three months project duration)	Rs.2,00,000/-
Recommendation	Recommended

Conditions for approval:


1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
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 RUSA Co-ordinator. 15/2/23


 15/2/23

To.

Principal Investigator / Co-PI

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Phone: (+91) 4565 223253	E-mail: rusa.alucoordinator@alagappauniversty.ac.in	

Rc.Alu/RUSA 2.0 / EIR /2023

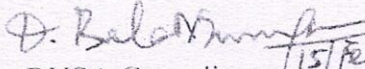
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Animal Health and Management
Principal Investigator (PI)	Dr.N.M.Prabhu Assistant Professor
Co-Investigator (Co-PI)	Dr.S.Palanisamy Research Professor Dr.B.Vaseeharan Professor and Head.
Title of the Project	Standardization of isolation techniques for commercial production of fucoidan and investigation of their biological activities.
Project Duration	12
First Installment (for the first three months project duration)	Rs.3,22,500/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
2. All the request letters / purchases should be routed through the Program Officer, EIC Hub, Alagappa University for taking further action.
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 RUSA Co-ordinator. 15/2/23
 15/2/23

To.

Principal Investigator / Co-PI

	ALAGAPPA UNIVERSITY (A State University Established by the Government of Tamil Nadu in 1985, Accredited with A+ Grade by NAAC (CGPA 3.64) in the Third Cycle, Graded as Category-I University and Granted Autonomy by MHRD-UGC, MHRD-NIRF 2020 Rank : 36, QS 2020 India Rank : 24) KARAIKUDI - 630 003, Tamil Nadu, India	
	Phone: (+91) 4565 223253	

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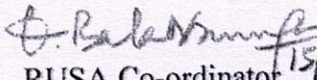
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Biotechnology
Principal Investigator (PI)	Dr.P.Rameshthangam Assistant Professor
Co-Investigator (Co-PI)	----
Title of the Project	Microbial production of high purity pre biotic isomalto-oligosaccharides.
Project Duration	12
First Installment (for the first three months project duration)	Rs.3,55,000/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
2. All the request letters / purchases should be routed through the Program Officer, EIC Hub, Alagappa University for taking further action.
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 RUSA Co-ordinator. 15/ Feb/23
 15/2/23
 15/2/23

To.

Principal Investigator / Co-PI

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Phone: (+91) 4565 223253	E-mail: rusa.alucoordinator@alagappauniversity.ac.in	

Rc.Alu/RUSA 2.0 / EIR /2023

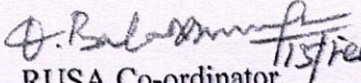
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Biotechnology
Principal Investigator (PI)	Dr.S.Gowrishankar Assistant Professor
Co-Investigator (Co-PI)	---
Title of the Project	Development of pathoblockers based topical formulations and pre-clinical evaluation against VVV-BV mixed vaginitis : a beginning towards antivirulence drug commercialization
Project Duration	12
First Installment (for the first three months project duration)	Rs.1,95,750/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
2. All the request letters / purchases should be routed through the Program Officer, EIC Hub, Alagappa University for taking further action.
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 RUSA Co-ordinator. 15/2/23
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To.

Principal Investigator / Co-PI

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	Phone: (+91) 4565 223253	

Rc.Alu/RUSA 2.0 / EIR /2023

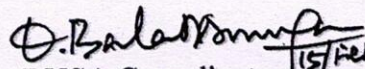
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Biotechnology
Principal Investigator (PI)	Dr.K.Balamurugan Prof. and Head
Co-Investigator (Co-PI)	B.C. Muthu Bharathi
Title of the Project	Development/ Fabrication of bio-detector for biological sample analysis in the microfluidic platform
Project Duration	12
First Installment (for the first three months project duration)	Rs.3,29,250/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
2. All the request letters / purchases should be routed through the Program Officer, EIC Hub, Alagappa University for taking further action.
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4. Only one quarter of the budget approved is sanctioned as the first instalment and the remaining grant will be sanctioned based on the Expert Committee's recommendation.
5. The Product / Prototype / Process shall solely belong to Alagappa University and the rights whatsoever arising there from shall be with Alagappa University.


 RUSA Co-ordinator. 15/2/23

15/2/23
 15/2/23

To.

Principal Investigator / Co-PI

	<h2>ALAGAPPA UNIVERSITY</h2> <p>(A State University Established by the Government of Tamil Nadu in 1985, Accredited with A+ Grade by NAAC (CGPA 3.64) in the Third Cycle, Graded as Category-I University and Granted Autonomy by MHRD-UGC, MHRD-NIRF 2020 Rank : 36, QS 2020 India Rank : 24)</p> <p>KARAIKUDI - 630 003, Tamil Nadu, India</p>	
Phone: (+91) 4565 223253	E-mail: rusa.alucoordinator@alagappauniversity.ac.in	

Re.Alu/RUSA 2.0 / EIR /2023

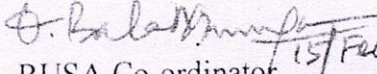
15.02.2023


**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Animal Health and Management
Principal Investigator (PI)	Dr.V.Nithya Assistant Professor
Co-Investigator (Co-PI)	----
Title of the Project	Diversification of dairy farming in rural areas of Tamil Nadu by promoting sustainable value-added products of Polyunsaturated fatty acids from cow milk
Project Duration	12
First Installment (for the first three months project duration)	Rs.1,87,500/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
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 RUSA Co-ordinator. 15/2/23


 15/2/23

To.

Principal Investigator / Co-PI

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Phone: (+91) 4565 223253	E-mail: rusa.alucoordinator@alagappauniversity.ac.in	

Rc.Alu/RUSA 2.0 / EIR /2023

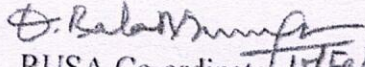
15.02.2023

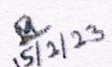

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Biotechnology
Principal Investigator (PI)	Dr.K.Pandimadevi Professor
Co-Investigator (Co-PI)	Dr.S.Aravindh Executive Director & CSO
Title of the Project	Eco -friendly Herbal Pesticide formulation Against Mealy Bugs
Project Duration	12
First Installment (for the first three months project duration)	Rs.3,75,000/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
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 RUSA Co-ordinator. 15/Feb/23

 15/2/23
 15/2/23

To.

Principal Investigator / Co-PI

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Phone: (+91) 4565 223253	E-mail: rusa.alucoordinator@alagappauniversty.ac.in	

Rc.Alu/RUSA 2.0 / EIR /2023

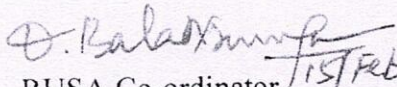
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Animal Health and Management
Principal Investigator (PI)	Dr.P.Kumar Assistant Professor
Co-Investigator (Co-PI)	----
Title of the Project	Development of Silica based nanotheranostics targeting breast cancer.
Project Duration	12
First Installment (for the first three months project duration)	Rs.1,28,250/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
2. All the request letters / purchases should be routed through the Program Officer, EIC Hub, Alagappa University for taking further action.
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 RUSA Co-ordinator. 15/2/23

To.

Principal Investigator / Co-PI

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Phone: (+91) 4565 223253	E-mail: rusa.alucoordinator@alagappauniversty.ac.in	

Rc.Alu/RUSA 2.0 / EIR /2023

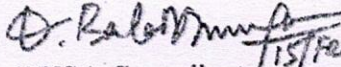
15.02.2023

**Proposal approved for Entrepreneurship in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Bioelectronics and Biosensors
Principal Investigator (PI)	Dr.V.Dharuman Assistant Professor
Co-Investigator (Co-PI)	Dr.J.Mathiyarasu Senior Scientist Central Electrochemical research institute
Title of the Project	Cost effective renewable diabetic sensor for home and personal care
Project Duration	12
First Installment (for the first three months project duration)	Rs.3,55,000/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
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 RUSA Co-ordinator.
 15/2/23
 15/2/23

To.

Principal Investigator / Co-PI

	<h2 style="margin: 0;">ALAGAPPA UNIVERSITY</h2> <p style="margin: 0;">(A State University Established by the Government of Tamil Nadu in 1985, Accredited with A+ Grade by NAAC (CGPA 3.64) in the Third Cycle, Graded as Category-I University and Granted Autonomy by MHRD-UGC, MHRD-NIRF 2020 Rank : 36, QS 2020 India Rank : 24)</p> <p style="margin: 0;">KARAIKUDI - 630 003, Tamil Nadu, India</p>	
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Rc.Alu/RUSA 2.0 / EIR /2023

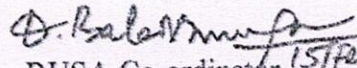
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Bioelectronics & Biosensor
Principal Investigator (PI)	Dr.C.Sekar Professor and Head
Co-Investigator (Co-PI)	Dr.A.Rathinavel Dean Madurai Medical College and Hospital
Title of the Project	An Electrochemical Sensor for Early Non-Invasive Diagnosis of Hepatic Disorders.
Project Duration	12
First Installment (for the first three months project duration)	Rs.5,00,000/-
Recommendation	Recommended

Conditions for approval:

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 RUSA Co-ordinator. 15/2/23
 15/2/23
 15/2/23

To.

Principal Investigator / Co-PI

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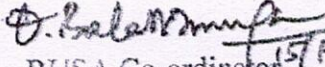
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Industrial Chemistry
Principal Investigator (PI)	Dr.S.Viswanathan, Assistant Professor
Co-Investigator (Co-PI)	Dr.S.Karuppuchamy Professor and Head
Title of the Project	Solar- Powered Electrochemical Technologies for Textile wastewater Treatment
Project of Duration	12
First Installment (for the first three months project duration)	Rs.2,89,500/-
Recommendation	Recommended

Conditions for approval:

1. This approval is subject to revision/cancellation based on the review on completion of three months of the project and the milestones proposed.
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 RUSA Co-ordinator. 15/2/23

15/2/23
 15/2/23

To.

Principal Investigator / Co-PI

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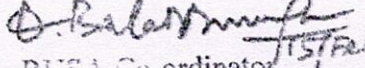
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Nanoscience and Technology
Principal Investigator (PI)	Dr.P.Shakkthivel Piraman Professor
Co-Investigator (Co-PI)	Chandrasekaran Ramasamy Alumni
Title of the Project	A Compact Flow Capacitor Analysis Using Gel Electrolytes for future Energy storage Devices.
Project Duration	12
First Installment (for the first three months project duration)	Rs.3,62,500/-
Recommendation	Recommended

Conditions for approval:

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 RUSA Co-ordinator. 15/2/23

15/2/23
 15/2/23

To.

Principal Investigator / Co-PI



ALAGAPPA UNIVERSITY

(A State University Established by the Government of Tamil Nadu in 1985,
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MHRD-NIRF 2020 Rank : 36, QS 2020 India Rank : 24)

KARAIKUDI - 630 003, Tamil Nadu, India



Phone: (+91) 4565 223253

E-mail: rusa.alucoordinator@alagappauniversity.ac.in

Rc.Alu/RUSA 2.0 / EIR /2023

15.02.2023

Proposal approved for Entrepreneur in Residence Scheme under EIC Hub of RUSA 2.0

Department	Nanoscience and Technology
Principal Investigator (PI)	Dr.P.Shakthivel Piraman Professor
Co-Investigator (Co-PI)	---
Title of the Project	Developing Holistic Infrastructure of high voltage solid state Li-Ion Battery For Electric Mobility Applications.
Project Duration	12
First Installment (for the first three months project duration)	Rs.5,00,000/-
Recommendation	Recommended

Conditions for approval:

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D. Balasubramanian
RUSA Co-ordinator
15/2/23

To.

Principal Investigator / Co-PI

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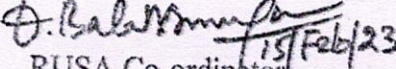
15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Library and Information Science
Principal Investigator (PI)	Dr.S.Thanuskodi Professor & Head
Co-Investigator (Co-PI)	Dr.S.Kishore Kumar Deputy Librarian
Title of Project	Current Research Information System for Tamil Nadu
Project Duration	12
First Installment (for the first three months project duration)	Rs.3,50,000
Recommendation	Recommended.

Conditions for approval:

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 RUSA Co-ordinator

15/2/23
 15/2/23

To.

Principal Investigator / Co-PI

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Phone: (+91) 4565 223253	E-mail: rusa.alucoordinator@alagappauniversity.ac.in	

Re.Ah/RUSA 2.0 / EIR /2023

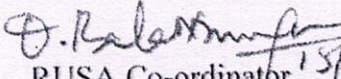

15.02.2023

**Proposal approved for Entrepreneur in Residence Scheme under
EIC Hub of RUSA 2.0**

Department	Microbiology
Co-ordinator	Prof. A.Arun Professor and Head
Principal Investigator (PI)	Dr.R.Yuvakkumar Assistant Professor
Industrial Partner	Dr.V.Swaminathan H2next Pvt Ltd.,
Title of the Project	Waste to Energy : Large scale sewage Treatment Plant (STP) and production of Green hydrogen and Bioelectricity using an innovative process
Project Duration	12
First Installment (for the first three months project duration)	Rs.42,00,000/-
Recommendation	Recommended

Conditions for approval:


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 D. Balakrishnan
 RUSA Co-ordinator. 15/02/23


To.

Principal Investigator / Co-PI

Evaluation and Commercialization of Collagen Based ZnO Curcumin Incorporated Smart Wound Dressing Device for Wound Healing

Principal Investigator Name	Dr. B. Vaseeharan, Professor, Department of Animal Health and Management, Alagappa University (Science Campus), Karaikudi	
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Objectives

- To evaluate the wound healing effect of jellyfish collagen based ZnO curcumin nanocomposite (Jfc -ZnO CN) incorporated smart wound dressing device
- To investigate the antimicrobial property of jellyfish collagen based ZnO curcumin nanocomposite incorporated smart wound dressing device against wound associated pathogenic bacteria.
- To setup preclinical wound healing experiments with the developed wound dressing device using murine models for validation, patenting and commercialization

Summary of the work done

Jellyfish from various locations in Tamil Nadu were collected, processed, and subjected to an acid extraction method to obtain collagen. The purified collagen underwent analyses such as SDS-PAGE, HPLC, GCMS, and NMR to assess purity and characteristics. A jellyfish collagen-ZnO curcumin nanocomposite was synthesized, and its physical structure confirmed through TEM and SEM analysis. Biochemical parameters were evaluated using UV-Vis Spectroscopy, FTIR, and XRD to understand ZnO nanoparticle synthesis and analyze functional groups. Toxicity testing was conducted on artemia, fish, and mice models. Electrospinning was used to produce nanofibers, soaked in an aqueous ZnO curcumin nanocomposite solution, and optimized through concentration variation. Post-electrospinning treatment involved washing, soaking, rinsing and drying under nitrogen flow.

In addition, this study determines the antimicrobial effectiveness of JfC-ZnO CN against various bacteria, both gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*, *Proteus vulgaris*, *Citrobacter freundii*, *Moragnella morgani*) and gram-positive (*Enterococcus faecalis*, *Staphylococcus aureus*, *Bacillus sp*) strains. Antibiofilm activity were tested by introducing different concentrations of JfC-ZnO CN (25 µg/ml, 50 µg/ml, and 75 µg/ml) to bacterial cultures and allowing incubation for 3 days at 37 °C.

For clinical experimentation, following animal care guidelines of Alagappa University, mice study was conducted. Mice weighing 20-25 grams undergo anaesthesia with a drug cocktail, and two wounds are inflicted on their back skin. Wounds are dressed with JfC-ZnO-CN wound dressing, and mice are monitored daily. No polydine is used to avoid interference with dressing properties. At the end, mice are euthanized, and wound tissue is collected for histology. Tissue samples are stored in formalin for analysis, involving H&E staining by a blinded expert. The proposed JfC-ZnO-CN wound dressing shows effective wound infection treatment, potentially replacing traditional methods.


Status: Ongoing

Outcome of the project

The advance wound management in Indian market currently achieve tremendous attractive rates of growth. The outcome of this study is a multifunctional product – a sophisticated nanocomposite wound dressing derived from jellyfish collagen. This innovative dressing exhibits antimicrobial properties, making it a potential replacement for traditional wound care methods. In this scenario, the proposed product is new and novel JfC -ZnO CN wound dressing device, which is effective in treating wound infection and it substitute the traditional wound dressing. Now the product JfC -ZnO CN wound dressing device being in its validation stage and for wound care management, following it commercialization steps is in process with Progen Biotech Private Ltd for successful marketing.



Biochar Based Inoculum Development for Sustainable Agriculture

Principal Investigator	Dr. T. Kavitha, Assistant Professor, Department of Microbiology, Alagappa University (Science Campus), Karaikudi	
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Objectives

- ❖ To Select the suitable biomass for biochar Production.
- ❖ Production and Characterization of biochar.
- ❖ Adapting methodology for designing biochar for better adsorption of PGPR.
- ❖ Improve the longevity of PGPR to be more effective for colonization.

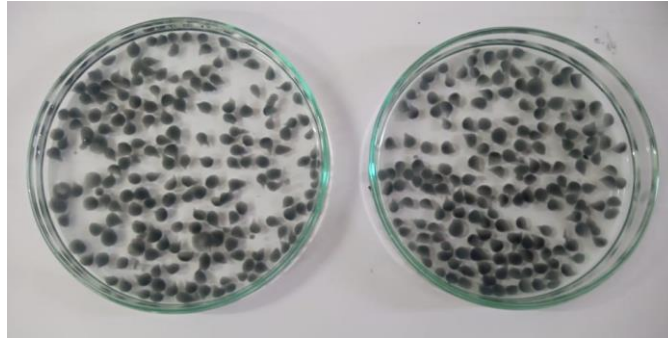
Summary of the work done

The project focuses on developing a sustainable agricultural inoculum using biochar as a carrier for Plant Growth Promoting Rhizobacteria (PGPR). The agricultural waste corncob biomass was collected and dried for 24 h to remove moisture content. The corn cob biomass went through pyrolysis, a method involving the heating of biomass in absence of oxygen, was employed to produce biochar at various temperatures ranging from 250°C to 900°C were tested. Among this biochar produced at 900°C exhibited higher conductivity, indicating its potential as an effective carrier. The obtained biochar was analysed for surface morphology using Scanning electron microscopy (SEM) this step provides insights into the physical structure (porosity) and characteristics of the biochar. The development of this commercial product contains microbial consortium such as *Achromobactersp*, *Bacillus*sp, *Pseudomonas* sp. The microbial consortium is blended with the biochar the incorporation of beneficial microorganisms into the carrier matrix will subsequently enhance plant growth and soil fertility. The blended mixture was further mixed with sodium alginate for encapsulation the mixture was introduced drop by drop into a calcium chloride solution. The process facilitates the formation of calcium alginate beads, which acts as carrier for encapsulated microorganisms.


Status: On-going

Outcome of the project

The developed biochar-based inoculum encapsulated with PGPR, will ensure the sustainable release of microbes to the soil, improve the soil fertility. When compared to the conventional method of inoculum development this biochar-based inoculum developed from renewable source, Hence the cost of production is low.



Nutrigenomics and computational prospective studies on Parkinson disease

Principal Investigator Name	Dr. M. Karthikeyan, Associate Professor, Department of Bioinformatics, Alagappa University (Science Campus), Karaikudi	
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Objectives

- Understand the molecular mechanism of genes and nutritional supplements (nutrients, minerals, and vitamins) responsible and regulatory role in Parkinson disease pathogenesis and treatment.
- Screening of plant compounds against PD target proteins to identify the binding efficacy.
- Investigate the molecular mechanism of non-synonyms deleterious SNPs, how significantly associated with Parkinson disease pathogenesis

Summary of the work done

Parkinson's disease arises due to a deficiency in the synthesis of dopamine hormone within the substantia nigra region of the brain. In light of this premise, we have selected nine specific genes and the signalling pathway of these selected genes was studied through pathway analysis (Preliminary study).

In the follow-up of the pilot study, significant non-synonymous SNPs (nsSNPs) associated with these Parkinson's disease risk associated genes were identified using various computational tools and the impact of these nsSNPs (deleterious/neutral nature) was segmented. The results obtained from this study were subsequently developed as an Interactive database (Product) known as the Parkinson's Disease-Associated Single Nucleotide Polymorphism Database (PDASD) and the web-hosting of the database is under progress (<https://Pdasd.generisk.in/home.html>). This database will be more useful for the diagnostic purpose of Parkinson's disease because the SNPs of general population type of Parkinson's disease can be identified, followed by NGS analysis. It will

also be useful to researchers, the scientific community, the pharma industry, physicians, and the general public. The research subsequently progressed to the identification of potential leads for targeting proteins (major proteins identified in the initial pilot study) associated with Parkinson's disease. Various research articles have indicated that several herbal extracts from plants can regulate and stimulate the sufficient dopamine hormone production in humans.


Based on this concept, few plants were selected for this study via comprehensive analysis of relevant literature sources. The compounds from these selected plants were collected from the PubChem database and docked against target proteins to analyse their binding efficacy and orientation. The top leads from the molecular docking study were then subjected to pharmacokinetic and pharmacodynamic assessment (ADME/T prediction, DFT analysis, MMGBSA, and Molecular Dynamics Simulation). The manuscript for this study is under progress.

Status: Ongoing

Outcome of the project

An interactive database (product) entitled “Parkinson's Disease-Associated Single Nucleotide Polymorphism Database (PDASD)” was developed and the web-hosting of the database is under progress (<https://Pdasd.generisk.in/home.html>).

Development of Silica based nanotheranostics targeting breast cancer

Principal Investigator Name	Dr. P. Kumar, Assistant Professor, Department of Animal Health & Management, Alagappa University (Science Campus), Karaikudi	
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Objectives

To develop a non-invasive and more precise nanotheranostics system utilizing silica quantum dots targeting breast cancer cells.

Summary of the work done

Breast cancer remains a significant contributor to cancer-related mortality globally, highlighting the demand for advanced diagnostic and therapeutic interventions. The utilization of Silicon Quantum Dots (SiQDs) incorporated into transdermal patches represents an innovative strategy to address this challenge. SiQDs offer customizable optical characteristics and suitability for transdermal delivery, rendering them a promising option for localized breast cancer treatment. In this study, SiQDs were synthesized using a modified method and subsequently encapsulated within transdermal patches. These patches were then applied to in vitro models of breast cancer to evaluate their targeting efficiency, therapeutic efficacy, and diagnostic capabilities. Characterization of the SiQDs confirmed their uniform size distribution and tunable fluorescence emissions. When applied in vitro, the transdermal patches exhibited precise targeting, with the SiQDs preferentially binding to breast cancer cells. Therapeutically, the drug-loaded SiQDs within the patches induced apoptotic cell death in cancer cells effectively. Moreover, the SiQDs emitted intense fluorescent signals, facilitating accurate localization and diagnostic imaging. These findings highlight the potential of SiQDs encapsulated in transdermal patches for breast cancer management. Their distinctive optical properties, coupled with the localized delivery facilitated by transdermal patches, establish a multifunctional system for early detection and treatment. Compared to conventional diagnostic approaches, this method offers advantages in terms of localized

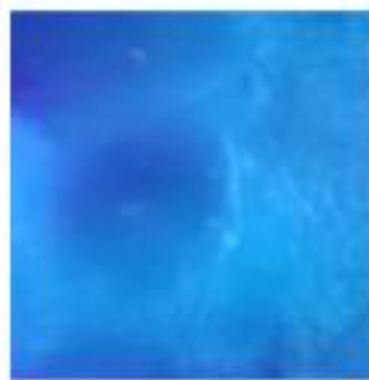
therapy and minimally invasive diagnostics. Further optimization of patch design, drug release kinetics, and clinical translation is warranted. Our future research endeavors should focus on refining the transdermal delivery system and conducting in vivo clinical trials to assess safety and efficacy. This study presents a promising advancement in breast cancer management through the utilization of SiQDs incorporated into transdermal patches. The unique optical properties of SiQDs and their compatibility with transdermal delivery offer exciting prospects for early diagnosis and localized treatment. Despite existing challenges, the potential clinical impact of this approach is substantial, offering a more precise and less invasive approach to breast cancer management.

Status: Ongoing


Outcome:

Developed a non-invasive and more precise silica quantum dots loaded transdermal patch targeting breast cancer cell lines.

**Silica quantum dots loaded transdermal patch
upon UV exposure**



Microbial production of high purity prebiotic isomalto-oligosaccharides

Principal Investigator Name	Dr. P. Rameshthangam, Associate Professor & Head(i/c), Department of Nutrition & Dietetics, Alagappa University (Science Campus), Karaikudi	
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Objectives

- To synthesize the low purity isomalto-oligosaccharides from *Debaryomyces hansenii*.
- To purify the isomalto-oligosaccharides (IMOs) to high purity IMOs using chromatography resins.
- To characterize the high purity IMOs with commercial samples.

Summary of the work done

An efficient recycling method was used to develop the continuous production of high purity isomalto-oligosaccharides (IMOs) by cell associated transglucosylase of a novel strain, *Debaryomyces hansenii* from maltose and purification by chromatography method. The most active transglucosylase producer was screened, isolated and identified as *D. hansenii* using LSU region sequencing. Parameter's optimization studies were investigated using whole cells of *D. hansenii* from 10 L fermenter to increase the enzyme activity through biotransformation. IMOs were continuously synthesized by reusing the cell biomass (6 %, w/v) using microfiltration membrane system with 30 % maltose concentration under controlled temperature of 34 °C in an average of 12 h for 5 cycles.

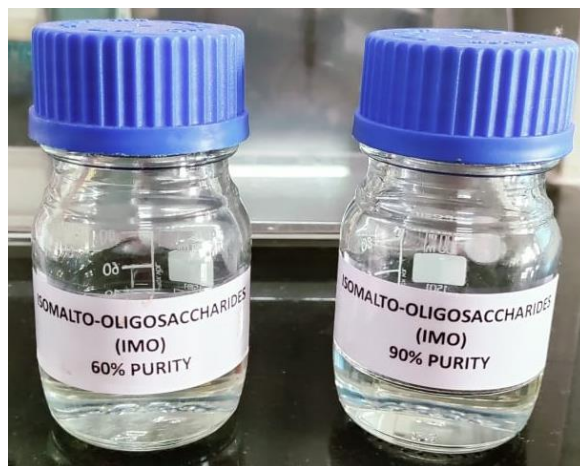
Furthermore, low purity IMOs (>60% purity) were passed through cationic ion exchange resins to obtain high purity IMOs (>89% purity) by separating glucose and maltose. The obtained product was purified to remove color and inorganic salts. The product was concentrated to 75 brix syrup and followed by pasteurization to eradicate microbes. This novel study uses whole cell biomass on higher concentration of maltose

and chromatographic separations was capable to produce IMOs with 89% purity and 60% yield with higher conversion efficiency and was confirmed by HPLC.


Status: Ongoing

Outcome of the project: Low purity & high purity IMO has been biosynthesized.

Image of the products:



Development of pathoblockers based topical formulations and pre-clinical evaluation against VVC-BV mixed vaginitis: A beginning towards ant-virulence drug commercialization

Principal Investigator Name	Dr. S. Gowrishankar, Assistant Professor, Department of Biotechnology, Alagappa University (Science Campus), Karaikudi	
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Objectives

- ✓ Developing topical formulations with appropriate active molecules *viz.*, ant virulence agents from natural resources against *C. albicans* and *G. vaginalis*.
- ✓ Physico-chemical characterization and *in vitro* efficacy evaluation of developed topical vaginal formulations over the 3 months of period.
- ✓ Preclinical evaluation/validation of anti-virulence based topical formulations for the effective treatment of VVC-BV using mixed vaginitis rat model.

Summary of work done

As a prelude, our group has completed the preliminary *in vitro* works dealing with the identification and synergistic efficacy evaluation of phytochemical combination (citral and carvacrol) on various virulence traits such as biofilm, yeast to hyphae transition, hydrolytic enzymes production of *Candida albicans* and *Gardnerella vaginalis* in mono and mixed state. Further, various topical formulations *viz.*, vaginal cream, gel and wash containing the identified synergistic combination at their anti-virulence concentrations were developed. Further, the developed synergistic topical formulations were tested for their efficacy and results confirmed that formulations were effective in inhibiting both *C. albicans* and *G. vaginalis*.

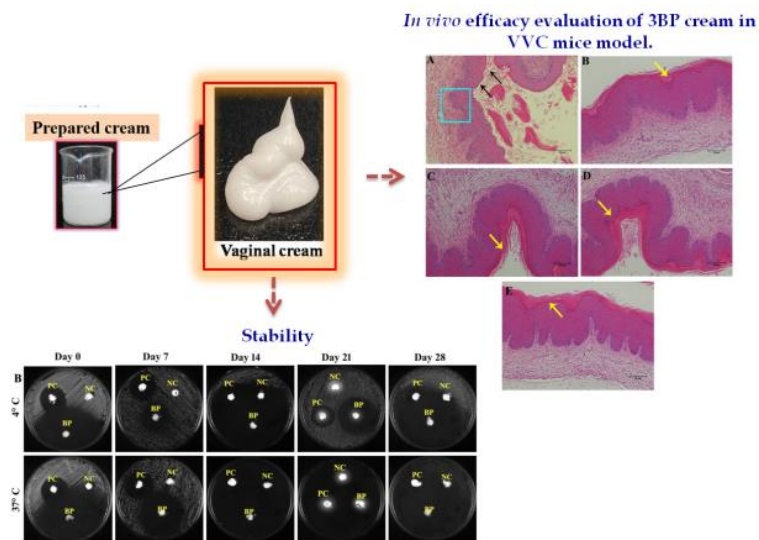


Figure 1: Inhibitory activity of vaginal cream formulation against *C. albicans* and *G. vaginalis*.

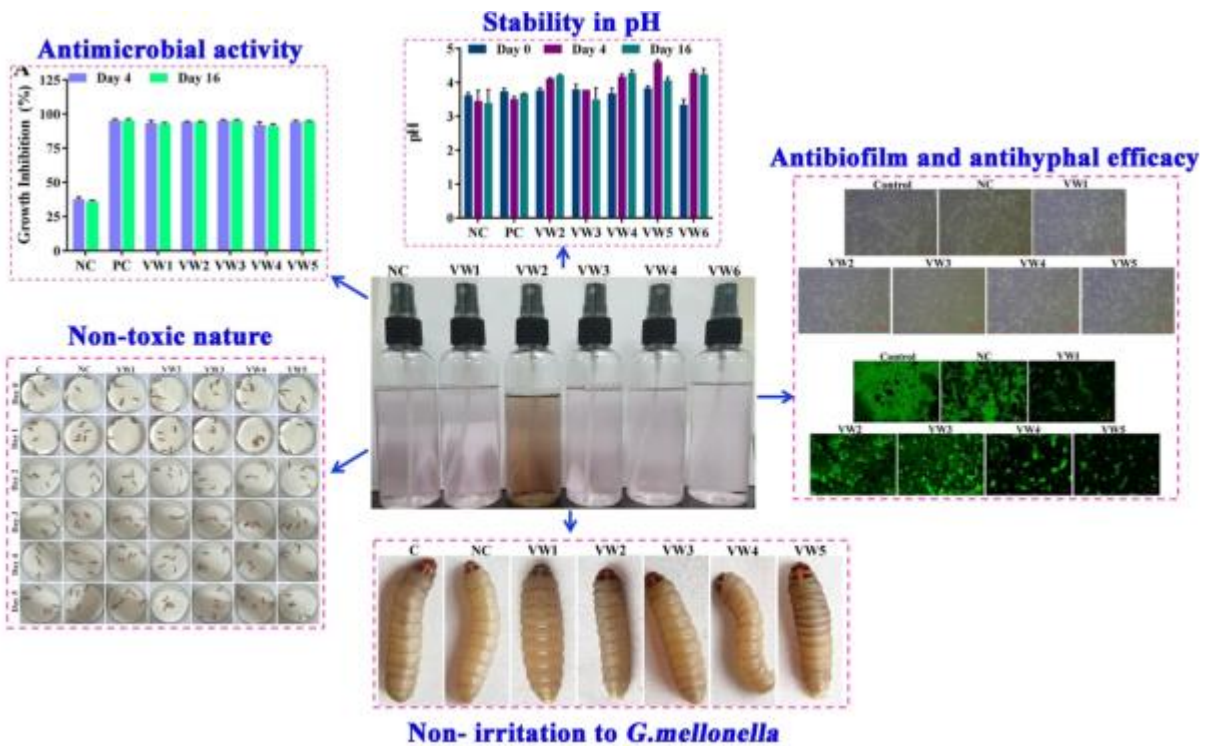


Figure 2: Inhibitory activity of vaginal wash formulation against *C. albicans* and *G. vaginalis*.

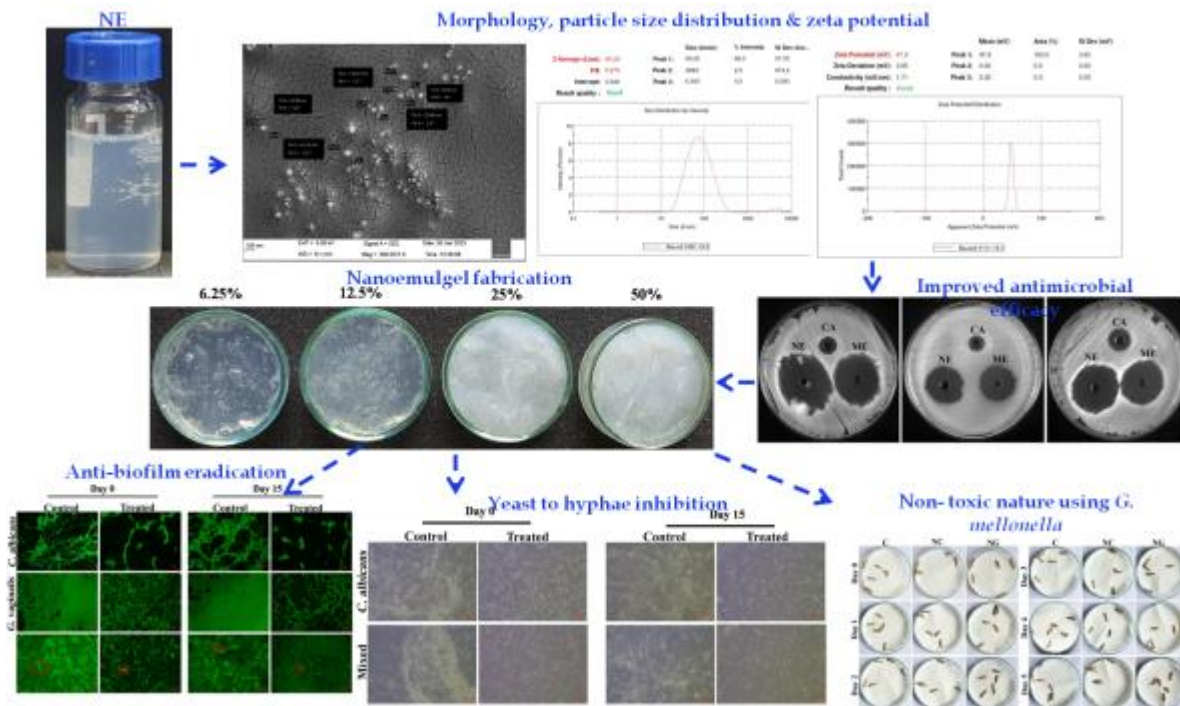



Figure 3: Inhibitory activity of vaginal nanoemulgel against *C. albicans* and *G. vaginalis*.

Status: Ongoing

Outcome of the project developed if any (Describe in one-or two-lines Processes/ prototype/ product):

We developed anti-virulence (phytochemicals) based topical formulations against mixed vaginitis and evaluated they're *in-vivo* models (*Galleria mellonella* and Female Wister rat) therapeutic efficacy, which would desperately be a “beginning towards anti-virulence drug commercialization”. The potential outcome of the current invention has been taken up towards Indian Patenting, through drafting **Invention Disclosure Form (IDF)** and subsequent submission to **IPR cell of Alagappa University**.

Development/Fabrication of bio-detector for biological sample analysis in the microfluidic platform

Principal Investigator Name	Dr. K. Balamurugan, Professor & Head, Department of Biotechnology, Alagappa University (Science Campus), Karaikudi	
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Objectives

- Designing microfluidic chip-based biosensor
- Development of animal sensory system for establishment of translational research
- Establishment of bio detector for screening bio-actives/compounds/drugs/metabolites/ natural compounds and food additives which includes:
 - a. Neurotoxicity of chemicals or their derived small molecules
 - b. Toxic effect of heavy metals from environment
 - c. Food additives/flavour enrichment test
 - d. Nanoparticles, quantum dots and metal oxide toxicity
 - e. Formulated food for Child/infant/expectant mother

Summary of the work done

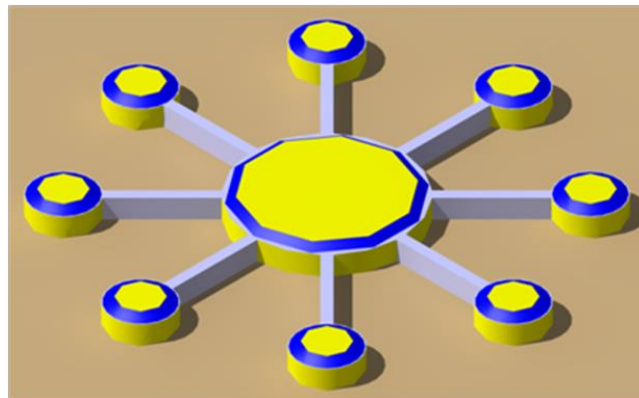
Current proposal focusing on development of microfluidic based bio detector which will overcome the issues raised due to topography of clinical and other biological samples. This study has been designed to address the impact of either attracted or avoided bacteria on the selection of different aroma of food materials and the importance of candidate neurotransmitters for the selection. The observations indicated that *C. elegans* pre-exposed with candidate bacterium has drastic variation in preference towards different odours. Further, it has been observed that in few cases, reversal of odour selection occurred due to the bacterial exposure after pre-treatment with agonist or antagonist of candidate neurotransmitters of *C. elegans*. The validation study carried out with chemotaxis defective mutant CB6038 also showed varied in odour preference which could be correlated with the candidate bacterial exposure and chemical pre-

treatment. Further, the relative gene expression profiles of candidate chemosensory neuronal players have also supported the importance of candidate neurotransmitters on the selection of different odours.

Status: Completed

Outcome of (prototype developed from) the project


The outcome of this preliminary screening study is expected to provide the advantage of *C. elegans* in understanding the chemical cues and impact of bacterial pathogens on the sensotaxis behaviour which pave a way to develop *C. elegans* as a biosensor device in the field of biological system based Artificial Intelligence (AI).



Schematic sketch of designed Microchip for chemotaxis assays

A nematode microfluidic chip is developed for the purpose of mimicking “lab on chip”. It can be used for observing chemotaxis/sensotaxis behavior of *Caenorhabditis elegans*. The microchip is designed in such a manner that *C. elegans* can move freely or revert back from any spotting region to the other. It contains outer eight independent spotting regions which are connected to the centre spotting region through linear lanes with 1 mm of depth. The centre and individual eight spotting region has a diameter of 8 mm and 3 mm, respectively. The lanes are 0.5 cm in length and 0.5 mm in width.

**Eco-friendly Herbal Pesticide formulation against Mealy Bugs
(Hemiptera: Pseudococcidae) using traditional plant leaf extracts
through fermentation with Pink Pigmented Facultative
Methylo trophs Consortium**

Principal Investigator	Dr. K. Pandimadevi, Professor, Department of Biotechnology, Alagappa University (Science Campus), Karaikudi	
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Objectives

The proposed work aims to the Eco-friendly Herbal Pesticide formulation against Mealy Bugs (Hemiptera: Pseudococcidae) using traditional plant leaf extracts through fermentation with Pink Pigmented Facultative Methylo trophs Consortium

- Screening of traditional plants with pest-repellent properties – Plants with latex, Plants with succulent leaves, plants that are not generally preferred by herbivores, and plants with repellent odor and bitter taste as screening criteria.
- Fermentation of the screened plant leaf pulp with Pink Pigmented Facultative Methylo trophs (PPFM) (Microrapid®)
- Field trial/Product Validation of the fermented extract enriched with pest retardant compounds and beneficial inoculums against Mealy Bugs (Hemiptera: Pseudococcidae) and crop health

Summary of the work done

During the initial period (0-3 months) of the project:

The following plants with repellent odor (*Volkameria inermis*) and bitter taste (*Citrullus colocynthis*, *Ipomoea carnea*, *Azadirachta indica*), plants with latex (*Jatropha gossypifolia*, *Calotropis procera*, *Nerium oleander*), succulent leaves (*Aloe barbadensis miller*, *Opuntia ficus-indica*), and those not generally preferred by herbivores (*Datura stramonium*, *Justicia adhatoda*) were selected for herbal biopesticide formulation.

Preparation of leaf pulp mixture

500g of all the selected plant leaves mentioned above were picked and pulped along with 500g of turmeric powder (*Curcuma longa*) using a commercial blender.

Fermentation of the leaf pulp with PPFM Methylo-troph Consortia

Chopped plant materials were placed in the silo of a Solid Substrate Fermentor and filled with 14 L of water, 420 ml of molasses, and 420 ml of PPFM Methylo-troph Consortia. The materials underwent fermentation for approximately 45 days. When the pH dropped to below 3.7, the solution (Fermented Herbal Pesticide - FHB) was passed through a 0.1 mm muslin cloth and diluted in water (0.5%).


Work to be done

1. Conduct *in vivo* bioassays on the Cotton Mealy bug, *Phenacoccus solenopsis*, by mass culturing them on sprouted potato tubers. Collect third-instar nymphs and perform bioassays using Fermented Herbal Pesticide (FHB) solutions. Assess mortality after 24, 48, and 72 hours.
2. Execute field trials using a randomized block design to evaluate FHB efficacy at 2.5% and 5% concentrations. Maintain an untreated control. Record mealy bug populations on selected plants after each of two sprays at 15-day intervals. Estimate percent reduction.
3. Repeat field trials every 3 months. Assess the population of mealy bug crawlers and adults per 5 cm shoot length from 10 randomly selected plants on days 3, 7, 10, and 14 after treatment. Estimate the mean percent reduction of the mealy bug population due to botanicals.

Status: Ongoing

Outcome of the project: Development of a novel fermented herbal pesticide (FHB) effective against the Cotton Mealy bug.

Cost effective renewable diabetic sensor for home and personal care

Principal Investigator	Dr. V. Dharuman, Department of Bioelectronics and Biosensors, Alagappa University (Science Campus), Karaikudi	
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Objective

Development of cost effective non-enzymatic glucometer for home and personal care.

Work done

Diabetes, a chronic disease, occurs due to accumulation of excess unutilized glucose in blood vessel, leading to various life-threatening physical impairments and death. The normal range of glucose level in blood approved world health organization (WHO) is 70 – 120 mg/dL. Increased glucose level > 140 mg/dL is diagnosed as diabetes. Recently, several glucometers are available in the market for home monitoring from various companies including one touch, lifestyle, accu check, free style, etc. Here, non-enzymatic glucose has been fabricated using metal oxide-gold nanoparticle for detecting glucose at pH 7.4.


1. Metal oxide – gold nanoparticle composite has been prepared and characterized by physical and chemical characterization techniques.
2. Screen printed carbon electrode is modified with Metal oxide – gold nanoparticle and studied electrochemical detection of glucose.
3. Sensor evaluated in physiological buffer for sensor characteristics.

Project Status: Ongoing

Outcome of the project

Sensor device is integrated with mobile, however, requires more experimental works for further implementation.

Solar Powered Electrochemical Technologies for Textile Wastewater Treatment

Principal Investigator Name	Dr. S. Viswanathan, Assistant Professor, Department of Industrial Chemistry, Alagappa University (Main Campus), Karaikudi	
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Objectives

To develop a dimensionally stable mixed metal oxide anode-based electrochemical flow reactor for textile wastewater treatment powered by solar energy.

Summary of the work done

Mixed metal oxide (MMO) anodes, fabricated by depositing (RuO₂) x (IrO₂) x layer on inert substrates, demonstrate significant promise in efficiently treating wastewater with challenging organic pollutants through electrochemical oxidation. Their superior electrocatalytic activity, driven by increased active sites and modified metal ion states, outperforms single-component mixed metal oxide anodes. Extensive research efforts have been dedicated to enhancing MMO anodes through surface modifications, including nano- and microstructure deposits, element doping, and polymer composites. Additionally, electrochemical oxidation at MMO anodes offers the advantage of combining direct and mediated oxidation processes, making it an appealing method for diverse water pollution scenarios. While MMOs exhibit heightened efficiency in acidic conditions and at high temperatures, determining the optimal operational parameters at an application scale remains a subject of ongoing debate. Yet, the precise relationship between the surface structure of MMO anodes and their electrocatalytic performance, as well as the role of reactive oxygen species (ROS) in pollutant removal or mitigation, remains unclear in the existing literature. Therefore, further research employing advanced characterization techniques is imperative. Additionally, MMO anodes face limitations such as a finite lifespan and the potential for toxic cation leaching in highly acidic solutions, potentially hindering their widespread application in electrochemical oxidation of organic pollutants.

This treatment method is characterized by its modularity, efficiency, and ease of automation and transportation, making it a promising solution for decentralized wastewater treatment systems. Our study involved the construction of an electrochemical reactor comprising a titanium mesh anode coated with mixed metal oxide (MMO). Monitoring the colour removal in effluent after each cycle using UV-VIS spectroscopy allowed us to assess the effectiveness of the process. Comparatively, electrochemical oxidation surpasses other decolorization methods, such as chemical treatment, in terms of cost-effectiveness, convenience, toxicity, and efficiency. In conclusion, these discoveries underscore the commercial promise of MMO-based electrochemical oxidation as a sustainable and effective method for wastewater treatment.

Status: Ongoing


Outcome of the project

A prototype electrochemical reactor was fabricated using a titanium mesh anode coated with mixed metal oxide (MMO) (RuO_2) x (IrO_2) x anodes.

Prototype electrochemical reactor



Fabrication Of Non-Invasive Tattoo Based Electrochemical Glucose Sensor

Principal Investigator Name	Dr. J. Wilson, Associate Professor, Department of Biosensors and Bioelectronics, Alagappa University (Science Campus), Karaikudi	
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Objectives

- To synthesis Graphene oxide/PEDOT composite by simple chemical method.
- To characterize the surface morphology by SEM and TEM and composition of the nano materials by XRD, RAMAN and XPS analysis.
- To functionalize the nanostructures with electrochemical mediators such as quinones, Prussian blue, tetrathiafulvalene etc, by chemical method.
- To examine the mode of interaction between the functionalized nanostructures and mediators by IR technique.
- To fabricate the temporary tattoo electrode.
- To develop electrochemical glucose biosensor.
- To design the amperometry circuit to develop a transducer.
- To optimise experimental conditions for In Vitro evaluation of glucose in sweat.

Summary of the work done

Graphene oxide (GO) was prepared using the modified Hummers method from pure graphite powder. The process involved mixing sulfuric acid and phosphoric acid, adding graphite powder, and adding potassium permanganate. The mixture was stirred to obtain dark green for 6 hours. To remove excess KMnO_4 , hydrogen peroxide was added and stirred for 10 minutes. The exothermic reaction occurred, and the solution was cooled. Hydrochloric acid and deionized water were added, centrifuged, and washed to produce the GO powder. The prepared GO and EDOT monomer was then added to the DI water containing $\text{Na}_2\text{S}_2\text{O}_8$ as an oxidant. The oxidative polymerization was carried out under vigorous stirring at 20°C for 24 hours. The untreated sodium residues were

removed by cation and anion exchange resins for 24 hours. The resulting PEDOT/GO powder was then dried in an oven at 90°C for 24 hours.

For optimization, four different concentration of GO was doped in terms of wt% ratio with EDOT monomer. Finally, we achieve GO of 1.5 wt% doped EDOT shows promising conductivity in glass carbon electrode.

Then the prepared PEDOT/GO powder was dispersed in DI water and then added to the methylene blue solution of 0.5 M concentration to form a functionalized composite ink. It was named as f-PEDOT/GO.


Status: Ongoing

Outcome of the project

The synthesized f-PEDOT/GO was loaded in the inkjet printer cartridge and the flexible three electrode substrate was fabricated. The flexible three electrode was successfully printed on the test A4 sheet as shown in below figure and the optimization for biosensing of sweat sample is going on.



Tamil Script Recognition and Speech Synthesis from Ancient Tamil Stone Inscriptions

Principal Investigator Name	Dr. M. Vanitha, Assistant Professor, Department of Computer Application, Alagappa University (Science Campus), Karaikudi	
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Objectives

- To identify Tamil characters engraved ancient citizens on stones by employing the principle of machine learning techniques.
- To undertake an automatic image processing to visualize the old Tamil characters.

Summary of the work done

Tamil script recognition system includes three stages such as image pre-processing to increase the quality of the query image, feature extraction to identify the specific values of the image, and classification to segment the image into meaningful information. The process of Tamil script recognition includes extraction of some characterized qualities called features to order an unknown character into one of the known classes.

Pre-processing: Pre-processing has been done using binarization, noise removal and skew correction.

Binarization

Image binarization changes over a picture of up to 256 Gray levels to a highly contrasting picture. The least complex approach to utilize image binarization is to pick a limit esteem, and group all pixels with values over this threshold as white, and every single other pixel as black.

Noise Removal

Digital images are inclined to an assortment of sorts of noises. Noise is the consequence of mistakes in the picture securing process that outcome in pixel esteems



Figure 1. Scanned Input Image



Figure 2. Binarized Image

that don't mirror the true intensities of the true scene. In the event that the picture is filtered from a photo made on film, the film grain is a wellspring of noise.

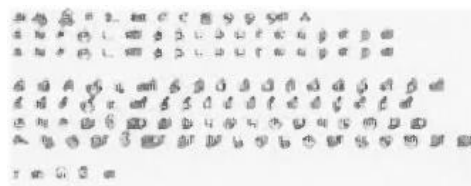


Figure 3. Noise Removed Image

Skew Correction

During content scanning, skew is definitely brought into the incoming scanned picture. Skew recognition is one the principal activities to be connected to checked records while changing over information to a computerized format. Scan line based skew detection has been utilized for skew correction.

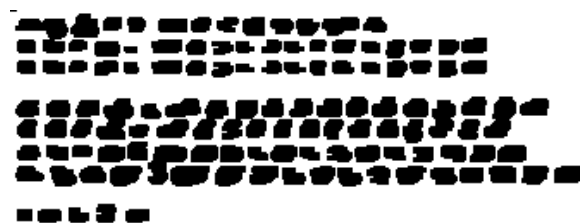


Figure 4. After Scan Line based Skew Detection

Segmentation

Segmentation is a stepwise procedure of recognizing lines, words, and even characters of a written by hand or machine-printed report, a step as it extricates the significant areas for analysis.

Line Segmentation: Obviously the ascenders and descenders frequently intersect up and down of the adjacent lines, while the lines of text might itself flutter up and down. Each content of the line resides on the non-existent line that individual use to expect while composing and a technique has been detailed in view of this thought.

Word and Character Segmentation: The procedure of word segmentation succeeds the line partition errand. The vast majority of the word segmentation issues more often than not focus on observing the gaps between the characters to recognize the words from each other. This procedure of separating words rose up out of the thought that the spaces between words are generally bigger than the spaces between the characters.

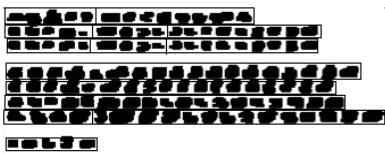


Figure 5. Line Segmentation



Figure 6. Word Segmentation

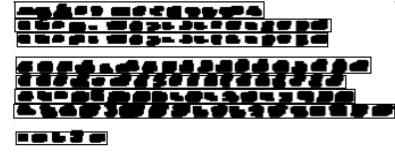


Figure 7.

Feature Extraction

Features are extracted While holding segregate data to feed the classifier. Measure of information is accomplished through vector portrayal that stores just two sets of ordinates supplanting data of a few pixels.

Classification

K-NN classifier is used.to manage learning calculation. It depends on least separation (Euclidean distance method) from the inquiry case to the preparation tests to decide the k-closest neighbours. The test is completed by differing the quantity of neighbours (K= 3, 5, 7) and the execution of the calculation is ideal when K = 3. To survey the execution of the classifier the list of capabilities of 100-word images are arbitrarily separated (roughly

equivalent) into five gatherings and a 5-fold cross approval is performed to get optimum result.

Status: Ongoing

Outcome of the project

Pre-processing, Segmentation, features extraction and classification have been done on Tamil inscription images for automatic image processing to visualize the old Tamil characters.

Innovation Academic Courses

12. Academic Courses in Innovation, Entrepreneurship and IPR

S. No.	Academic Year	Title of Course	Course Code	Type of Course	Level of Course (UG/PG/Ph.D)	Course Offering Department/ Centre/Unit Name	Total Credit Score
1	2020 - 2021, 2021-2022 and 2022-2023	Structural Biology	502302	Core Course	PG	Bioinformatics	5
2		Pharmacogenomics	502303	Core Course	PG		4
3		Computer Aided Drug Design (CADD)	502304	Core Course	PG		4
4	2020 - 2021, 2021-2022 and 2022-2023	SCUBA DIVING EQUIPMENTS AND COMMUNICATION	465203	Core Course	PG	Oceanography and Coastal Area Studies	5
5		SCIENCE OF SCUBA DIVING	465204	Core Course	PG		5
6	2022-2023	Nanotechnology and Advanced drug delivery system	533704	Core Course	PG	Nanoscience and Technology	2
7	2022-2023	Nanoelectronics and Nano Devices	533302	Core Course	PG		4
8	2022-2023	Nanoengineering	533303	Core Course	PG		4
9	2020 - 2021, 2021-2022 and 2022-2023	Legal Environment of International Business	652402	Core Course	PG	International Business	4
10		Customs Procedure and Documentation	652501	Core Course	PG		3
11		Business in Emerging Markets	652304	Core Course	PG		4
12	2020 - 2021, 2021-2022 and 2022-2023	Management of Learning Disability and Vocational Training for Transition & Job Placement	745207	Core Course	PG	Department of Special Education and Rehabilitation Science	2
13		Orientation & Mobility and Augmentative & Alternative Communication	745208	Core Course	PG		2
14		NaiTalim	745210	Core Course	PG		2
15		Counselling	744204	Core	PG		4

		Psychology		Course				
16		Sports Psychology	744207	Core Course	PG		3	
17		Spiritual Psychology	744209	Core Course	PG		3	
18	2020-2021	Folk and Tribal Painting	308503	Core Course	PG	Fine Arts	3	
19		Miniature Paining	308603	Core Course	PG		3	
20		Art Restoration and Conservation	308507	Core Course	PG		1	
21	2021-2022	Thanjavur Painting	308603	Core Course	PG		3	
22		Mural Painting	308703	Core Course	PG		3	
23	2022-2023	Kalamkari Painting	308503	Core Course	PG		3	
24		Mural Painting	308703	Core Course	PG		3	
25		3D Motion Graphics & VFX	308705-A	Elective	PG		3	
26	2022-2023	Social Entrepreneurship	452108	Core Course	PG		Social Work	4
27		Development Communication	515303	Core Course	PG		Journalism and Mass Communication	5
28	2022-2023	New Media Studies	515402	Core Course	PG	5		
29	2020-2021	Remote Sensing and GIS	464104	Core Course	PG	Geology	4	
30		Engineering Geology, Mining Geology, Ore Processing and Environmental Geology	464503	Core Course	PG		5	
31		2021-2022	Economic Geology	464301	Core Course		PG	5
32	Hydrogeology		464302	Core Course	PG		5	
33	Petroleum Geology		464504	Core Course	PG		5	
34	2022-2023	Geophysics	464301	Core Course	PG		4	
35		Geochemistry	464304	Core Course	PG		4	
36	2020-2021, 2021-2022 and 2022 - 2023	Photovoltaics	540202	Core Course	PG		Department of Energy Science	5
37		Energy Storage Systems	540203	Core Course	PG			5
38		Energy Practical-III	540307	Core Course	PG			4

39	2021-2022, 2022-2023	Entrepreneurship Development	518304	Core Course	PG	Life Long Learning	3
40	2020-2021, 2021-2022 and 2022 - 2023	Translation Studies	701304	Core Course	PG	Department of English	4
41	2020-2021, 2021-2022	Marketing of Banking Services	632404	Core Course	PG	Department of Bank Management	4
42		Digital Banking	632405	Core Course	PG		4
43	2022-2023	Fintech in Financial Sector	632E11	Elective	PG		4
44		Digital Banking Services	632305	Core Course	PG		4
45	2020- 2021,2021- 2022	Small Business Management	643402	Core Course	PG	Department of Logistics Management	4
46	2022-2023	Entrepreneurship & Innovation	654402	Core Course	PG		4
47	2020-2021, 2021-2022 and 2022 - 2023	Information Technology- Practice	932204	Core Course	PG	Department of Library and Information Science	4
48		Library Automation and Digital Library (Practice)	932303	Core Course	PG		5
49	2020-2021	Tourism and Travel Management	415504	Core Course	PG	Department of History	5
50	2022-2023	Cultural Heritage of India	415104	Core Course	PG		5
51		Art and Architecture of South India	415501	Core Course	PG		5
52		Tourism and Travel Management	415502	Core Course	PG		5
53		Historiography & Methodology	415303	Core Course	PG		5
54	2020-2021, 2021-2022 and 2022 - 2023	Computer Application for Data Analysis	455 501	Core Course	PG	Department of Economics and Rural Development	4
55		Issues in Indian Economic Development	455 203	Core Course	PG		4
56		Indian Financial Institutions and Markets	455 204	Core Course	PG		4
57	2020-2021	Internet of Things	546301	Core Course	PG	Department of Computational Logistics	5
58		Big Data Analytics and R Programming	546302	Core Course	PG		5
59		Machine Learning	546303	Core Course	PG		4

60	2022-2023	Virtualization & Cloud Computing	546504	Core Course	PG		4
61	2020-2021, 2021-2022 and 2022 - 2023	Social Welfare Administration in India	549502	Core Course	PG	Department of Politics and Public Administration	5
62	2022 - 2023	IoT and Robotics	551302	Core Course	PG	Department of Computer Science	5
63	2021-2022	Sports Training Methods	821112E	Elective	PG	Department of Physical Education and Health Sciences	4
64		Scientific basis of yoga	813101	Core Course	PG		5
65		Principles of Yogic Therapy	813401	Core Course	PG		5
66	2020-2021, 2021-2022 and 2022-2023	Food Microbiology	530203	Core Course	PG	Department of Microbiology	5
67		Industrial Microbiology	530303	Core Course	PG		5
68		Microbial Technology	530506	Core Course	PG		4
69	2022-2023	Applied Microbiology II	530401	Core Course	PG		5
70	2020-2021 and 2021-2022	Forensic Science	508501	Core Course	PG	Department of Biomedical Science	3
71		Pharmaceutical Chemistry	508301	Core Course	PG		4
72	2022-2023	Bioinformatics and IPR	508501	Core Course	PG		
73	2020-2021	Machine Learning	541556	Core Course	PG	Department of Computer Applications	4
74		Big Data Analytics	541562	Core Course	PG		4
75	2021-2022	Information and Cyber Security	541557	Core Course	PG		4
76		Mobile Applications Development	541205	Core Course	PG		3
77	2022-2023	Professional Ethics	541553	Core Course	PG		3
78		Mobile Application Development	541557	Core Course	PG		3
79		Virtual Reality and Augmented Reality	541558	Core Course	PG		3
80	2021-2022	Fishery Biology and Aquaculture	509304	Core Course	PG	Department of Animal Health and Management	2
81	2022-2023	Business Skills in Zoology	DSE -1	Elective	PG		3
82	2020 -2021	Economic Zoology	509504	Core Course	PG		4

83	2020-2021, 2021-2022 and 2022- 2023	Emerging Technologies	501302	Core Course	PG	Department of Biotechnology	2
84		Bioentrepreneurship	501304	Core Course	PG		2
85		IPR Biosafety & Bioethics	501305	Core Course	PG		2
86	2020-2021, 2021-2022 and 2022- 2023	GST and Customs Law	611403	Core Course	PG	Department of Commerce	4
87		Entrepreneurship Development	611102	Core Course	PG		3
88		Business Legislations	611303	Core Course	PG		4
89	2021-2022 and 2022- 2023	Industrial Law	3174C3	Elective	PG		4
90	2020-2021 and 2021- 2022	Optimization Techniques	511303	Core Course	PG	Department of Mathematics	5
91		Coding Theory	511510	Core Course	PG		5
92	2022-2023	MATLAB	511511	Core Course	PG		
93	2020-2021	Sewing Machine Operator	9BF1J1	Elective	UG	Alagappa Institute of Skill Development	5
94		Fashion Retailing and Visual Merchandising	9BF3C2	Elective	UG		3
95		Pc Assembling and Troublshooting- Lab	9BV3G2	Elective	UG		4
96		Advanced Textile Design	9MF2C1	Elective	PG		4
97		Advanced Garment Construction	9MF3E6	Elective	PG		4
98		Visual Merchandising	9MF4G2	Elective	PG		6
99		Fashion Designer	9BF2J1	Elective	UG		4
100	2021-2022	Apparel Accessories and Surface Ornamentation – Lab	9BV3G2	Elective	UG		5
101		Software Engineering	9MS1C2	Elective	PG		4
102	2022-2023	Industrial Engineer	2BF4J1	Elective	UG		4
103		Software Developer	2BS6J1	Elective	UG	3	
104		Nano Textiles	2MF2C3	Elective	PG	4	
105		Fashion Styling and Photography	2MF4G3	Elective	PG	6	
106	2020 -2021, 2021-2022	Plant Biotechnology and IPR	525302	Core Course	PG	Department of Botany	5

107	and 2022-2023	Mushroom Cultivation	525702	Core Course	PG		2
108	2020-2021	Biotechniques, Biotatistics and Bioinformatics	525303	Core Course	PG		5
109	2022-2023	Commercial gardening and horticulture	525703	Core Course	PG		2
110	2020 -2021, 2021-2022 and 2022-2023	Community Development	458501	Core Course	PG	Department of Women's Studies	4
111	2020-2021	Civil Society Organisation	458301	Core Course	PG		5
112	2020-2021	Counselling	458301	Core Course	PG		5
113	2021-2022 and 2022-2023	Feminist Research Methodology	458103	Core Course	PG		4
114		Community Development	458504	Core Course	PG		4
115		NGO Management	458505	Core Course	PG		4
116		Counselling	458506	Core Course	PG		4
117	2021-2022	Marketing at Bottom of Pyramid	641328	Core Course	PG	Alagappa Institute of Management	3
118		Innovation and Entrepreneurship	641361	Core Course	PG		3
119		Legal Aspects of Business	641202	Core Course	PG		3
120		Design Thinking for Business	641362	Core Course	PG		3
121		Business Plan Development	641363	Core Course	PG		3
122	2020 -2021	Freshwater Fisheries and Management	547102	Core Course	PG	Department of Fisheries Science	4
123		Coastal and Marine Fisheries Management	547103	Core Course	PG		4
124		Ornamental Fish Farming and Aquarium Management	547203	Core Course	PG		4
125		Remote Sensing and GIS in Fisheries Management	547202	Core Course	PG		3
126		Freshwater Aquaculture	547204	Core Course	PG		3

127		Shellfish and Finfish Hatchery Management	547301	Core Course	PG		3
128		Aquaculture and Live Feed Production	547303	Core Course	PG		3
129		Coastal and Marine Fisheries	547103	Core Course	PG		4
130	2022 - 2023	Ornamental Aquaculture	547302	Core Course	PG		4
131		Fish Processing Technology and Quality Assurance	547303	Core Course	PG		4
132	2020-2021 and 2021-2022	Geoinformatics in Disaster Mitigation	646302	Core Course	PG		5
133		Disaster Response	646402	Core Course	PG		5
134	2021-2022	Disaster Recovery	646403	Core Course	PG		5
135		Preparedness and Mitigation	646 301	Core Course	PG	Department of Disaster Management	4
136	2022 - 2023	Geospatial technology in Disaster Management	646 302	Core Course	PG		4
137		Rehabilitation and Reconstruction	646402	Core Course	PG		4
138	2020-2021 and 2021-2022	Applied Psychology and Yogic Counseling	724115	Core Course	PG		4
139		Yogic Management of Life style related disorders	724116	Core Course	PG		4
140		Yogic Diet and Nutrition	724118	Core Course	PG	Centre for Yoga	4
141		Science of Meditation	7245C2	Elective	PG		4
142	2022-2023	Yogic Therapy for Common Ailments	7246C1	Elective	PG		6
143		Yogic Science	724NME1	Elective	PG		2
144	2021 - 2022	Biomaterials	542501	Core Course	PG	Department of Bio Electronics and Bio Sensors	3
145		Molecular Electronics	542502	Core Course	PG		3
146		Bioelectronics	542516	Core Course	PG		3

147	2020-2021, 2021-2022 and 2022- 2023	Advanced Molecular Spectroscopy	521301	Core Course	PG	Department of Physics	4
148	2022-2023	Company Law & Practice – I	622101	Core Course	PG	Department of Corporate Secretaryship	4
149		Financial and Cost Accounting	622104	Core Course	PG		4
150		Economic and other Legislations	622304	Core Course	PG		3
151		Corporate Compliance Management	622402	Core Course	PG		4
152		Drafting and Conveyancing	622404	Core Course	PG		4
153		GST and Customs Law	622405	Core Course	PG		4
154		2020-2021, 2021 -2022	Styles of Acting	414206	Core Course		PG
155	Post Production Techniques - Editing & Sound		414306	Core Course	PG	2	
156	Intelletual Property Rights		414506	Core Course	PG	3	
157	2022-2023	Improvisation and Styles of Acting	414305	Core Course	PG	Department of Theatre and Film Studies	2
158		Post Production Techniques	414306	Core Course	PG		2
159		Intelletual property Rights	414503	Core Course	PG		3
160	2020-2021, 2021 -2022	Tourism Business Innovations and Entrepreneurship in Tourism	645403	Core Course	PG	Department of Tourism and Hotel Management	3
161				Core Course			
162	2022-2023	Entrepreneurial Innovations in Tourism	645403	Core Course	PG	Department of Tourism and Hotel Management	4
163		Entrepreneurship	22BE3	Elective	UG		2
164	2020-2021	Yogic Science	811103	Core Course	PG	Alagappa University College of Physical Education	4
165		Test, Meaurement and Evaluation in Physical Education	811501	Core Course	PG		4

166	2021-2022	Sports BioMechanics & Kinesiology	811202	Core Course	PG		4
167	2022 -2023	Physiology of Exercise	811102	Core Course	PG		4
168		Sports Technology	811501	Core Course	PG		4
169		Athletic Care and Rehabilitation	811203	Core Course	PG		4
170		Scientific Principles of Sports Training	811301	Core Course	PG		4
171		Education Technolgy in Physical Education	811403	Core Course	PG		4
172		2020-2021, 2021-2022	Mozhipeyarppiyal	411204	Core Course		PG
173	Velai vaippu Tamil		411306	Core Course	PG	2	
174	Tamilazha Koyirkalaigal		411305	Core Course	PG	4	
175	2022-2023	Tamilazha Koyirkalaigal	411305	Core Course	PG	4	
176		Kanini Tamil	411106	Core Course	PG	4	
177		Ethalliyal mattrum thagaval thodarpiyal	411704	Core Course	PG	2	
178		2020-2021 and 2021-2022	Advanced Educational Psychology	741102	Core Course	PG	4
179	Educational Statistics		741201	Core Course	PG	5	
180	Planning of Economy and Financing in Education		741402	Core Course	PG	4	
181	Policy in Education		741507	Core Course	PG	4	
182	2022-2023		Advanced Educational Psychology	741102	Core Course	PG	4
183		Research Methods in Education	741103	Core Course	PG	4	
184		Advanced Educational Statistics	741201	Core Course	PG	4	
185		Advanced Educational Technology	741203	Core Course	PG	4	
186		Guidance and Counselling	741506	Core Course	PG	4	
187		ICT in Education	741304	Core Course	PG	4	
188		Human Rights Education	741509	Core Course	PG	4	

189		Quality Assurance in Education	741512	Core Course	PG		4
190	2020-2021, 2021-2022 and 2022 - 2023	Environmental and Green Chemistry	536054	Core Course	PG	Department of Industrial Chemistry	4
191		Basics in Environmental Science	536073	Core Course	PG		2
192	2022 - 2023	Natural products and Introductory Biochem	536051	Core Course	PG		4
193		Materials Chemistry	536055	Core Course	PG		4
194		Chemical & Electrochemistry	536056	Core Course	PG		4

Innovation Outcomes



ALAGAPPA UNIVERSITY

**(State University | A+ Grade by NAAC (CGPA : 3.64) in the 3rd Cycle | Category - I
University by MHRD - UGC)**

Karaikudi

**UNIVERSITY BUSINESS COLOBORATION
CENTRE (UBCC)**

Booklet for NAAC SSR

University Business Collaboration Centre (UBCC)

Dr. A. Arun

Co-Ordinator- UBCC


Dr. V. Sugumar

Deputy Coordinator- UBCC

Year	No. of MoUs	
	National	International
2023 onwards	1. Theevanam additives, IITM research park, Chennai 2. Bohar Biobee Pvt. Ltd., Coimbatore 3. Agam Labs, Madurai. 4. Yaazh Genomics, Madurai. 5. Theevanam additives, Chennai and Bohar Biobee Pvt. Ltd., Coimbatore	6. SHYVA SAS, France

Energy from Waste 10KLD Sewage Treatment Plant (STP)

Dept. of Physics and Microbiology along with Memfill Tech. Pvt. Ltd (A Sister concern of GRT- an in-house Industry partner of Alagappa University developed a Sewage Treatment Plant (STP) at Karaikudi Municipality, Sivaganga District, Tamil Nadu



காரைக்குடி பெருநகராட்சி

கழிவுநீர் சுத்திகரிப்பு நிலையம்

முனிசிபாலிட்டி காலனி, காரைக்குடி

Technology Developed by: MEMFILL TECH PVT. LTD. & ALAGAPPA UNIVERSITY



Manufactured & Maintaining By: MEMFILL TECH PVT. LTD. Karaikudi ☎ 9444877555



Alagappa University
Dept. of Physics and Microbiology
&
Industry - H2next Pvt Ltd and Memfill Tech. Pvt. Ltd



World leaders at Mission Innovation's launch at COP21 in Paris, 2015



- 2015 - United Nations Climate Change Conference at Paris.
- Mission Innovation - Launched during COP21, 2015 between 24 countries.
- Mission Innovation- aims to accelerate global clean energy innovation to address climate change.
- At the launch, 24 countries committed to double national clean energy R&D investment by 2021
- 15B to 30B UDS/yr.
-

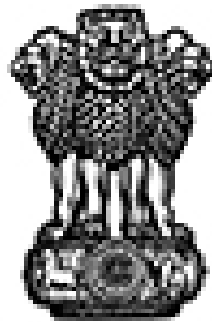


Hydrogen Valley Platform in India (2023) aims in scaling-up hydrogen deployments and creating interconnected hydrogen ecosystems across India



**MISSION
INNOVATION**

accelerating the clean energy revolution

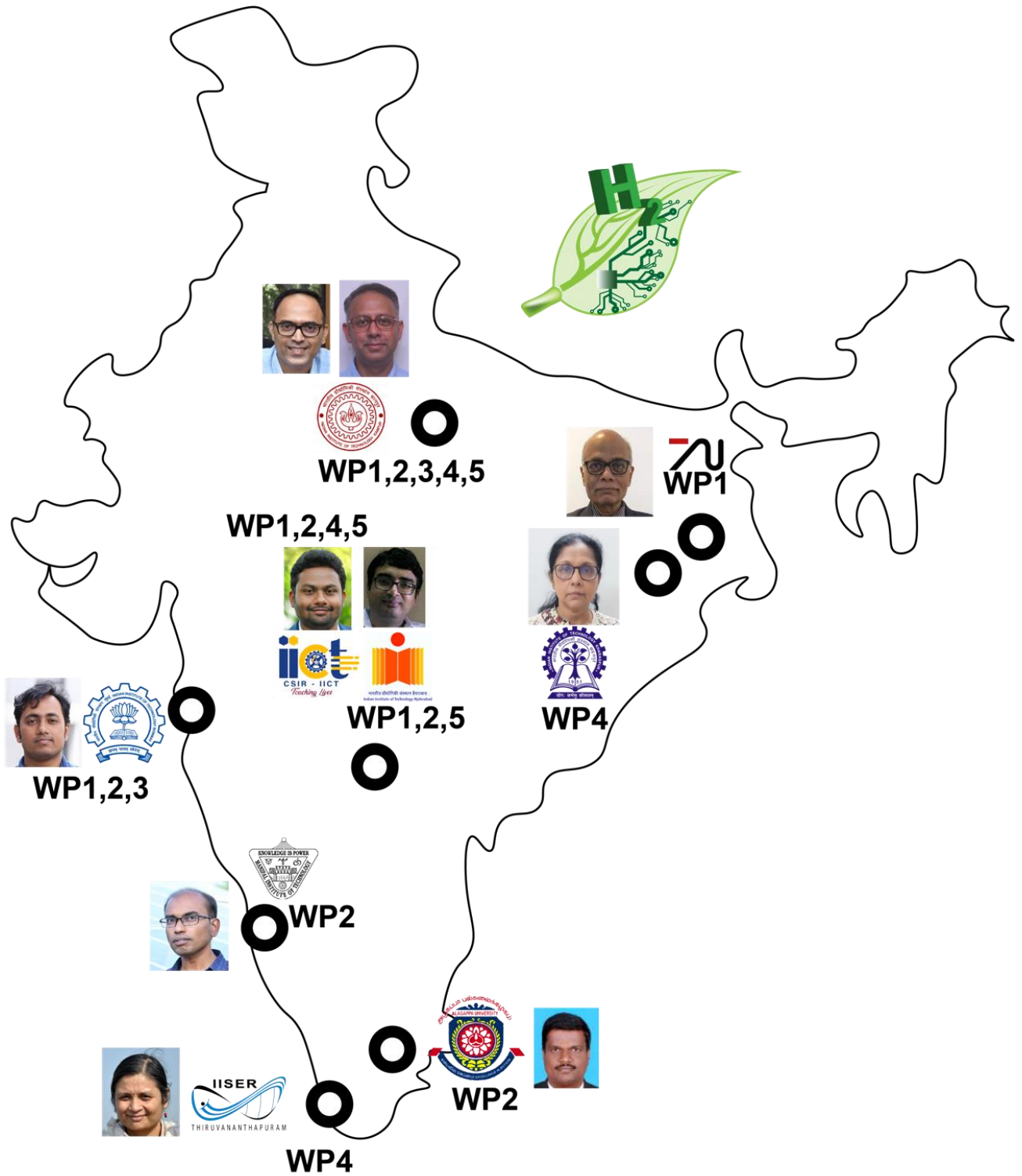


सत्यमेव जयते

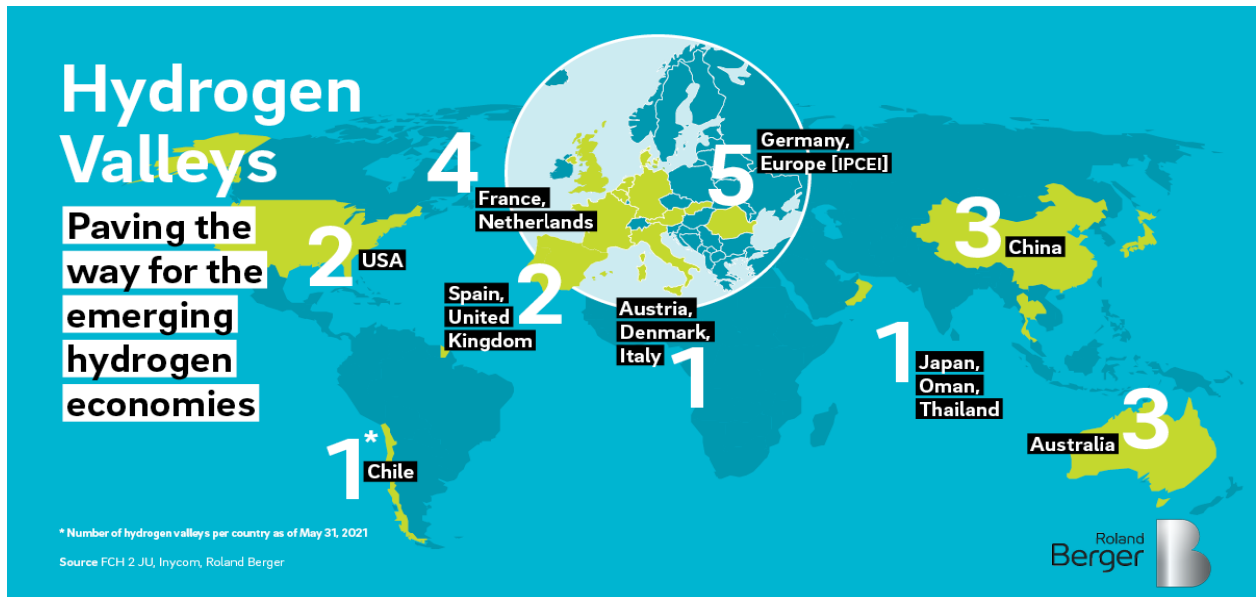
**Department of Science and Technology
Ministry of Science & Technology
Government of India**

1. Bio-Energy MAP
2. Materials MAP
3. Storage MAP

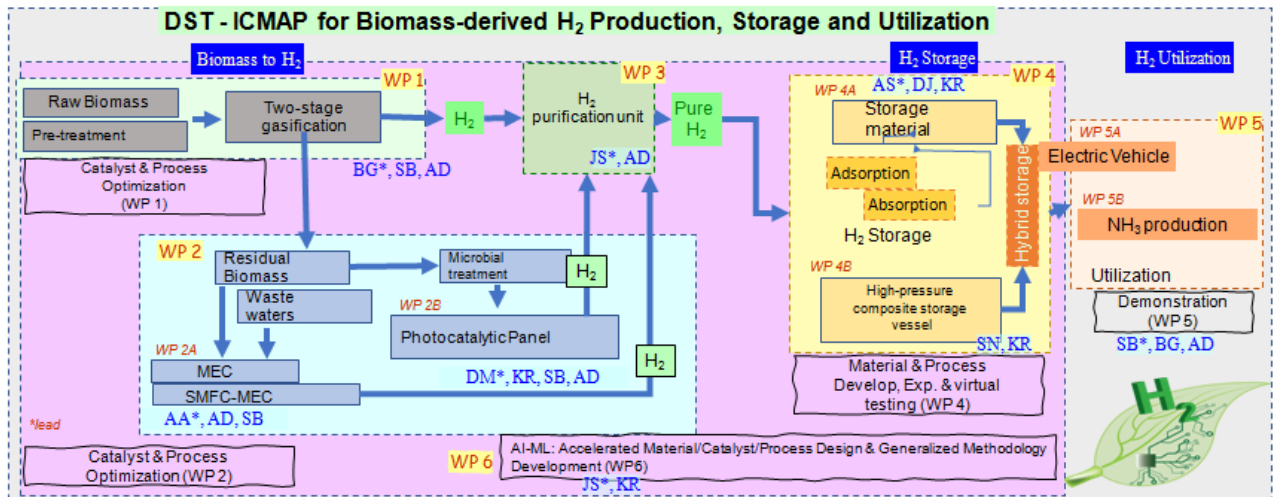
Bio-Energy MAP - Rupees 11.8 Crore



Under MISSION INNOVATION - “Hydrogen Valley” is a geographical area - hydrogen applications are combined together into an integrated hydrogen ecosystem



DST - ICMAP for Biomass-derived H₂ Production, Storage and Utilization



Experts: Microbiology, Engineer, Catalyst, Materials, Kinetics, AI and ML



In-house Institutional Industries

- Galaxy Research Technologies, Karaikudi
- H2Next Private Ltd, Karaikudi





Specialization of H2next Pvt Ltd

Wastewater treatment plant around 200 plants



H2nextAEM™ membranes



Microfiltration systems



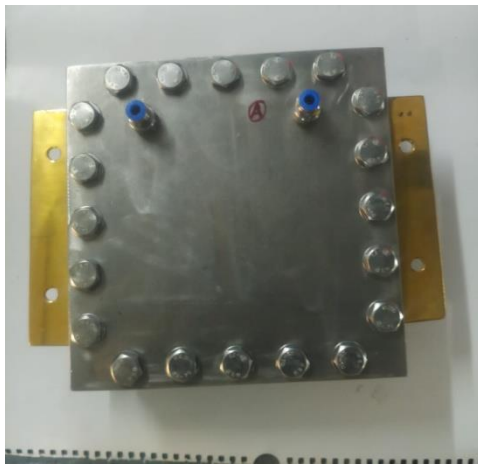
Hollow fibre membranes



PEM Electrolyser



AEM Electrolyser





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University by MHRD - UGC)**

Karaikudi

BIO-PLASTIC CENTRE

Booklet for NAAC SSR

BIO-PLASTIC CENTRE

Dr. A. Arun
Co-Ordinator- UBCC
12.05.2020 Onwards

Initiated commercialization of Institutional R&D outcome – Bioplastic



Ref: BBS/CON/PROJ/2023/01

Date:15-May-2023

CONSULTANCY PROJECT

To

- | | |
|--|---|
| 1. Prof. Mukesh Doble,
Director,
THEEVANAM ADDITIVES &
NUTRACEUTS PVT LTD, IIT MADRAS
RESEARCH PARK,
CHENNAI- 600036. | 2. Prof A. Arun,
Professor and Head,
Department of Microbiology,
Science Campus,
Alagappa University,
Karaikudi ,630003. |
|--|---|

Sub: Looking for Bioplastic - PLA product development based on the consultancy project proposed - Reg:

Dear Prof. Mukesh Doble and Prof. Arun,

Good Wishes.

Continuing our telephone discussion, I am sending this official request for the Research Consultancy.

Bogar Bio Bee Stores Private Limited is involved in offering top-quality products that spell excellence. Bogar Bio Bee Stores Pvt Ltd is ISO 9001-2015, ISO 13485:2016 certified company. Our platform is driven by insightful professionals and Research and Development facility with innovative and inventive products.

Bogar Bio Bee Stores Private Limited wants to do R&D and make products based on your research experience. Hence, we want a consultancy project, especially in Poly Lactic Acid (PLA) product development.

Bogar Bio Bee Stores Private Limited would like to start this consultancy project tentatively from May 2023 and will pay a sum of Rs 7,00,000.00 for six months for doing the PLA work. The instruments at our labs and Alagappa University In-house R&D lab, which will be developed, can be utilized for this consultancy project.

We hope you will consider the offer and await any communication from you.

Thanking you
With Regards



BOGAR BIO BEE STORES PRIVATE LIMITED

TICEL bio park Phase -III, Module No.104, 1st floor, Maruthamalai Road, Coimbatore-641046. Tamil Nadu.

Ph +91 9043755205 Web: www.biobeestore.com Email: info@biobeestore.com

GSTIN:33AAGCB6892G1Z1 | Drug Licence No.: TN/CBS/21B/00037 | TN/CBS/20B/00037

Bogar Bio Bee Stores Pvt Ltd., Coimbatore

Emirates Professor Mukesh Doble from IIT Madras, Chennai, Founding Director, Start-up Company – Theevanam) at IIT Madras Incubation Cell (IITMIC).

Dr. A. Arun, Dept. of Microbiology

PLA (Biodegradable Plastic) Production
7 Lakhs for 6 Months

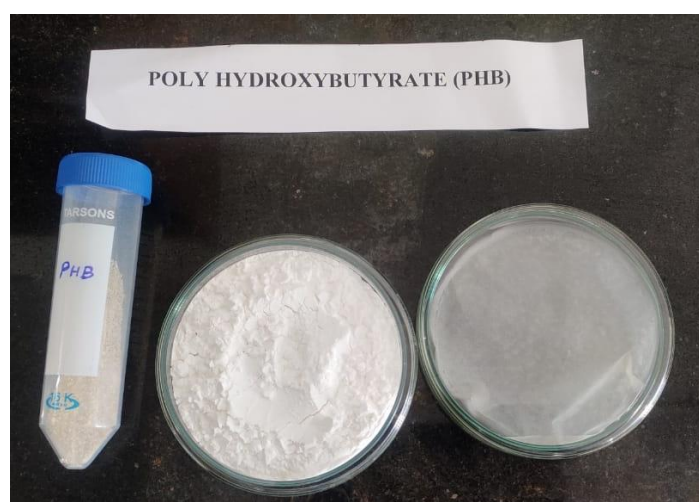
Galaxy Research Technologies, Karaikudi



Galaxy Research Technologies (Consultancy Project) - Rs. 3.6 for 1 Year

Biodegradable plastic (PHB) Produced at Department of Microbiology

Mohanrasu, K., Premnath, N., Siva Prakash, G., Sudhakar, M., Boobalan, T., Arun, A., 2018. Exploring multi potential uses of marine bacteria; an integrated approach for PHB production, PAHs and polyethylene biodegradation. *Journal of Photochemistry and Photobiology B: Biology*, Vol.185, (August 2018), Pages 55-65 (**IF 6.814**), ISSN: 1011-1344. <https://doi.org/10.1016/j.jphotobiol.2018.05.014>.



RUSA 2.0 – Entrepreneur in Residence (EIR) Scheme - Rs. 2.00 L - Ongoing

BIODEGRADATION TESTING BIOPLASTIC FILM

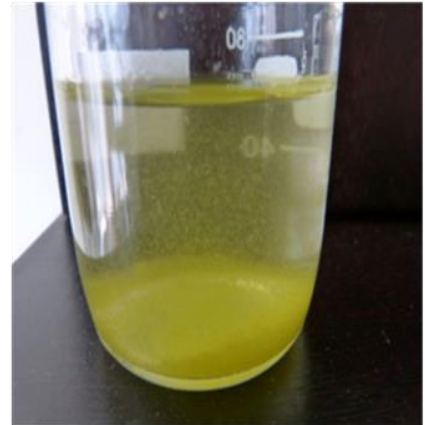
100% Biodegradable in Sea Water



After 30 days

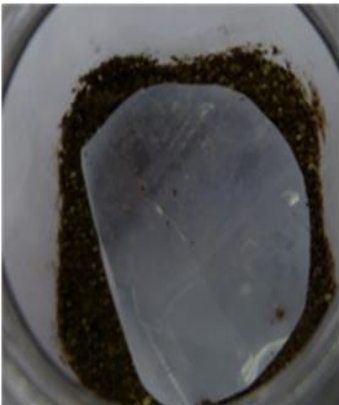


After 60 days



After 140 days

100% Biodegradable in Soil



0 day



After 60 days



After 90 days

Publications related to the proposed work from our Lab (Cumulative Impact factor- 60)

1. Mohanrasu, K., Guru Raj R.R., Dinesh, G.H., Zhang, K., Siva Prakash, G., Song, D., Muniyasamy, S., Pugazhendhi, A., Jeyakanthan, J., Arun, A., 2020. Optimization of media components and culture conditions for polyhydroxyalkanoates production by *Bacillus megaterium*. Volume 271, 117522. Fuel. <https://doi.org/10.1016/j.fuel.2020.117522> (IF – 8.035).
2. Jiang, H., Ding, Y., Liu, J., Arun, A., Pan, L., Song, D., Zhang, K., Li, Y., 2020. Super-Tough Poly (lactic acid) and Sustainable Elastomer Blends Compatibilized by PLLA-*b*- PMMA Block Copolymers as Effective A-*b*-C Type Compatibilizers. Industrial & Engineering Chemistry Research. ACS Publication. <https://doi.org/10.1021/acs.iecr.0c00988> (IF: 4.326).
3. Dinesh, G.H., Nguyen, D.D., Ravindran, B., Chang, S.W., Dai-Viet, N.Vo., Quang-Vu Bach, Tran, H.N., Jothi Basu, M., Mohanrasu, K., Murugan, R.S., Swetha, T.A., Sivaprakash, G., Arokiyaraj, S., Arun, A., 2020. Simultaneous Biohydrogen (H₂) and Bioplastic (Poly-β-Hydroxybutyrate-PHB) Productions under Dark, Photo, and Subsequent Dark and Photo Fermentation Utilizing Various Wastes. International Journal of Hydrogen Energy. ISSN: 0360-3199. (IF: 7.139) <https://doi.org/10.1016/j.ijhydene.2019.09.036>
4. Mohanrasu, K., Guru, R.R., Dinesh, G.H., Zhang, K., Sudhakar, M., Pugazhendhi, A., Jeyakanthan, J., Kumar, P., Govarthan, M., Arun, A., 2021. Production and Characterization of biodegradable Polyhydroxybutyrate by *Micrococcus luteus* isolated from marine environment. International Journal of Biological Macromolecules. DOI: <https://doi.org/10.1016/j.ijbiomac.2021.07.029> (IF – 8.025).
5. Mohanrasu, K., Premnath, N., Siva Prakash, G., Sudhakar, M., Boobalan, T., Arun, A., 2018. Exploring multi potential uses of marine bacteria; an integrated approach for PHB production, PAHs and polyethylene biodegradation. Journal of Photochemistry and Photobiology B: Biology, Vol.185, (August 2018), Pages 55-65 (IF 6.814), ISSN: 1011-1344. <https://doi.org/10.1016/j.jphotobiol.2018.05.014>
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Considering the **National need**, specific **new product** / process / **technology** / service **developed** :

- **4 scholars** had visited Tianjin University, China for characterizing their samples and trained up in Advanced Instrumentation Methods.
- Related to **bioplastic R&D 12 research articles in cumulative impact factor of 60**.
- We **prepared Super-Tough Poly (lactic acid)** and Sustainable Elastomer Blends (Published in Industrial & Engineering Chemistry Research. ACS - IF: 3.573).
- ***B. megaterium* isolate produced 5.61 g/L of PHB** (Published in Fuel - IF: 5.578).
- ***M. luteus* produced 11.58 g/L of PHB in batch fermentation** (Unpublished data).



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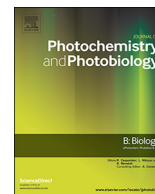
Prof. Mukesh Doble,

IIT-M, Chennai

Publications with international Collaborations

Prof. Kunyu Zhang, China, Prof. Dong Po Song, China and Dr. Sudhakar Muniyasamy, South Africa

1. Mohanrasu, K., Guru Raj R.R., Dinesh, G.H., **Zhang, K.**, Siva Prakash, G., Song, D., **Muniyasamy, S.**, Pugazhendhi, A., Jeyakanthan, J., **Arun, A.**, 2020. Optimization of media components and culture conditions for polyhydroxyalkanoates production by *Bacillus megaterium*. Volume 271, 117522. Fuel. <https://doi.org/10.1016/j.fuel.2020.117522> (IF – 8.035).
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Exploring multi potential uses of marine bacteria; an integrated approach for PHB production, PAHs and polyethylene biodegradation

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ABSTRACT

There are copious of bacteria exist in marine environment and it is very important to screen the potential microbes that has the ability to produce biopolymer polyhydroxybutyrate (PHB) as well as polycyclic aromatic hydrocarbons (PAHs) degradation and conventional plastic high density polyethylene (HDPE) biodegradation. Numerous studies have been investigated individually on either one of characteristic feature like PHB production, PAHs and high density polyethylene (HDPE) degradation, but not all together. Hence, in this study, we tried to screen potential marine microbes that have the ability to perform all three features. We have isolated 203 phenotypically different colonies from 19 different sites (marine soil sediments, marine water and oil spilled marine water) which cover the north east to down south seashore regions of Tamilnadu, India. Of the 203 microbial isolates, the best PHB producing (*Micrococcus luteus*), PAHs degradation (*Klebsiella pneumonia*) and HDPE degradation (*Brevibacillus borstelensis*) microorganisms were identified through 16S rRNA sequencing. Analytical studies confirmed PHB production by fourier transform infrared spectroscopy (FT-IR) and nuclear magnetic resonance (¹H & ¹³C NMR); PAHs degradation by high performance liquid chromatography (HPLC), confocal laser scanning microscopy (CLSM), scanning electron microscopy (SEM); HDPE degradation by CLSM, FT-IR and SEM which cover the spectroscopy studies on biological systems.

1. Introduction

It is hypothesized that the evolution and habitability of our earth starts with microbial origin [1]. Microorganisms are one of the prime biological systems involved in sustainability and maintenance of any given ecosystem with prompt adaptation in accordance to environment and deterioration [2]. Among the various ecosystems, marine ecosystem comprised more of about 178,000 species including 34 phyla [3] that constitutes for nearly 71% of earth surface area [4].

The scientific and technological development in serving the human for modern life has developed lot of environmental problems. The huge amount of non-degradable plastic waste has become a key factor in creating environmental pollution [5]. The usage of non-biodegradable synthetic plastics are creating energy crisis, damage to ecosystem and health issues to the mankind. Synthetic plastic substituted natural supplies in various aspects of day-to-day human life and turn out to be an crucial part of our society [6]. Poly-β-hydroxybutyrate (PHB) well examined biopolymer which could be utilized as a prefect substitute for

synthetic polymers [7,8]. Until few reports are available on marine PHB producing microorganisms [7].

Polyethylene [6] and hydrocarbons [9] are the largest contaminants in marine environments. Marine microbial ecosystem exhibits very high adaptability and tolerance against various physical and chemical conditions [10,11]. The cycling of pollutants in marine ecosystem is carried out by microbial actors at molecular, cellular, community and ecosystem level [12]. Marine bacteria carry wide variability of bioremediation possibility that is both beneficial for environmental and in commercial point of view [13]. The research on bioremediation potential of polyethylene [14], PAHs [15] and bioaccumulation of PHB [16] by the marine microorganism were studied individually. But the combined level of PHB bioaccumulation and potential degradation of PAHs and HDPE by marine microbes were not reported. Based on the involvement of marine microorganisms in PHB production and degradation of PAHs and HDPE, in this study we isolated microbes from 19 different sites (marine soil sediments, marine water and oil spilled marine water) which cover the north east to down south seashore regions of Tamilnadu, India. The potential isolates

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Thermal-chemical and biodegradation behaviour of alginic acid treated flax fibres/ poly(hydroxybutyrate-co-valerate) PHBV green composites in compost medium

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ABSTRACT

In this study, thermal-chemical and biodegradation behaviour of green composites based on flax fibres untreated and treated with alginic acid treated, and poly hydroxybutyrate-co-valerate (PHBV) were studied under composting conditions. The biodegradability of PHBV composites and neat PHBV were assayed by monitoring CO₂ production from polymeric carbon under controlled aerobic composting conditions as per ASTM D5338 standard. During the biodegradation process, PHBV composites thermal-chemical and morphology properties were characterized by thermogravimetric analysis (TGA), fourier transform infra-red (FT-IR) and scanning electron microscopy (SEM) techniques. The ultimate biodegradation (mineralization) study results showed alginic acid treated flax/PHBV composites has higher rate of degradation than untreated flax/PHBV composite and neat PHBV. TGA analysis indicated that an increased t-onset temperature for alginic acid treated flax fibres/PHBV composites which was mainly due to the influence of 2% sodium alginate treated with flax fibres. FTIR results showed the increased degradation of PHBV composites was due to the hydrolytic chain scission mechanisms influenced by presence of alginic acid and flax fibres as compared to neat PHBV matrix. Morphological SEM analysis showed PHBV composites biodegradation were readily attacked by fungus but rather PHBV degradation by bacteria. This study found that the incorporation of flax fibres into PHBV matrix provides a benefit to the green composites with enhanced biodegradability.

1. Introduction

The growing concern about environmental pollution due to post consumer plastics waste disposal is posing a challenge to industry and academia for the development of eco-friendly and sustainable green materials. Globally, there is much research interest in the area of sustainable biopolymers and biobased materials from bioresources for green manufacturing. Polymer composites based on natural fibres is currently receiving much attention as eco-friendly materials as replacement for synthetic fibres in various industrial sectors applications, such as automotive, construction and packaging applications. This

is mainly attributed favourable properties of the natural fibres such as low density, low cost and specific mechanical strength as well as environmental friendliness, renewability and economic sustainability (Luo and Netravali, 1999; John and Thomas, 2008; Faruk et al., 2012; Mohanty et al., 2002; Mohanty et al., 2018).

Microbial biopolymer mainly produced by microbial fermentation of renewable feedstock or directly extracted biopolymers from biomass are the new generation of materials and their renewability offers an intrinsic neutral carbon and save primary resources (Mooney, 2009; Muniyasamy et al., 2013; Sabapathy et al., 2019). Poly (3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) is a thermoplastic biopolyester produced by

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Biobased Biodegradable Polymers for Ecological Applications: A Move Towards Manufacturing Sustainable Biodegradable Plastic Products

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Abstract

In recent years, the emerging environmental concern for traditional plastic materials has posed a challenge to academia and industries to come up with an alternative eco-friendly material. This is because the post-consumer plastic items are non-biodegradable when disposed in natural environments such as landfill and marine sites. However, these plastics accumulate in these natural environments and create serious pollution that persists to cause environmental damage for decades. In order to address these issues, an innovative global circular economic concept in manufacturing new sustainable green products is currently underway to develop sustainable bioplastic products that will have economic, environment and social benefits. In this chapter the development of biopolymers directly extracted from biomass, monomer production from fermentation and microbial synthesis of biopolymer and their current potential applications are discussed.

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Simultaneous biohydrogen (H₂) and bioplastic (poly-β-hydroxybutyrate-PHB) productions under dark, photo, and subsequent dark and photo fermentation utilizing various wastes

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Abbreviations: Poly-β-Hydroxybutyrate, (PHB); Rice Husk Hydrolysate, (RHH); Rice Straw Hydrolysate, (RSH); Dairy Industry Wastewater, (DWW); Rice Mill Wastewater, (RWW); Dark Fermentation, (DF); Photo Fermentation, (PF); Standard Temperature and Pressure, (STP); Volatile Fatty Acids, (VFAs); Hydrogen Yield, (HY); Poly Hydroxy Alkanoate, (PHA); Photo Fermentative Hydrogen Production, (PFHP); Nitrogen Limited Minimal Synthetic, (NLMS); National Centre for Biotechnology Information, (NCBI); Basic Local Alignment Search Tool, (BLAST); Oxidation-Reduction Potential, (ORP); Chemical Oxygen Demand, (COD); Biological Oxygen Demand, (BOD); Ammonia-Nitrogen, (NH₄-N₂); Fourier Transform Infrared, (FTIR); Red, (R); Green, (G); Tri- Carboxylic Acid, (TCA); Purple Non-Sulfur, (PNS); Dark Fermented Effluent, (DFE); Dark Fermented Hydrolysate, (DFH); Substrate, (Sub.); Concentration, (Conc.); Fermentation, (Fer.); Autoclaved, (Auto.); Unautoclaved, (Unauto).

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Production and characterization of biodegradable polyhydroxybutyrate by *Micrococcus luteus* isolated from marine environment

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ABSTRACT

Marine microorganisms are reported to produce polyhydroxybutyrate (PHB) that has wide range of medical and industrial applications with the advantage of biodegradability. PHBs are synthesized as an energy and carbon storage element under metabolic pressure. The scope of this work is enhancing PHB production using marine microbial isolate, *Micrococcus luteus* by selectively optimizing various growth conditions such as different media components and growth parameters that influence the cell growth and PHB production were sampled. *Micrococcus luteus* produced 7.54 g/L of PHB utilizing glucose as a carbon source and ammonium sulphate as a nitrogen source with maximum efficiency. The same optimized operational conditions were further employed in batch fermentation over a time span of 72 h. Interestingly higher cell dry weight of 21.52 g/L with PHB yield of 12.18 g/L and 56.59% polymer content was observed in batch fermentation studies at 64 h. The chemical nature of the extracted polymer was validated with physio-chemical experiments and was at par with the commercially available PHB. This study will spotlight *M. luteus* as a potential source for large-scale industrial production of PHB with reducing environmental pollutions.

1. Introduction

An exponential surge of human population and poor waste management practices have resulted in the accumulation of a large volume of environmental pollutants and currently several researchers solving the problems [1–5]. The non-degradable wastes include plastics that are highly destructive to the environmental quality [6–8]. Conventional degradation techniques of plastics are dawdling and most of them release harmful toxins such as dioxins, furans, mercury and polychlorinated biphenyls to the environment [9,10]. Mounting apprehensions about environmental pollution from the mammoth accumulation of plastics in the ecosystems has highlighted the research requirement for developing bioplastics such as polyhydroxyalkanoates (PHAs) that are environmentally friendly [10,11]. PHAs are the polymers accumulated by bacteria as an

energy storage molecule under stress conditions such as with increased carbon source, and reduced oxygen, phosphorus and nitrogen [13]. Under these stress conditions, the carbon flow is channeled to PHA synthesis instead of being used for overall cell functions [14]. The most commonly deliberate examples of PHAs include poly(3-hydroxybutyrate-co-3-hydroxyvalerate) and polyhydroxybutyrate (PHB). The PHAs synthesized by micro-organisms are known to be biocompatible, non-toxic, biodegradable, thermoplastic, insoluble in water, and have characteristics (e.g., tensile strength) an analogous to synthetic plastic sources like polypropylene and polyethylene [15,16]. Hence, they serve as an excellent replacement for conventional plastics with additional benefit of being completely and quite rapidly degradable in both aerobic and anaerobic conditions by the action of microorganisms [17].

Marine environment provides a source of microorganisms with

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Extraction of microplastics from commonly used sea salts in India and their toxicological evaluation

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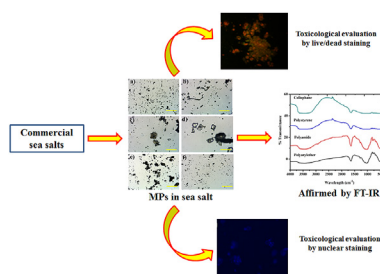
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HIGHLIGHTS

- Ten brands of commercial sea salts of different origin for the identification and characterization of MPs.
- The average abundance of MPs are <700 MP/kg with particles size ranging between 3.8 and 50.2 μm.
- Cellophane (CP), polystyrene (PR), polyamide (PA) and polyarylether (PAR) were identified from the salts.
- Dual and nuclear staining confirmed that the induction of apoptosis in microplastic treated HEK-293 cells.

GRAPHICAL ABSTRACT



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Sea salts

ABSTRACT

Microplastics (MPs) are one of the marine debris, accumulated in the ocean as a result of the successive breakdown of a large piece of plastics over several years. MPs are about less than 5 mM, have a detrimental impact on marine organisms/products (seafood/sea salts) and therefore they are considered as a global environmental pollutant. The occurrence and impact of MPs in commercial sea salts that are consumed by humans are not well studied so far. In the present study, we attempted to characterize and evaluate the *in vitro* toxicity of isolated MPs. Here, we have used ten brands of commercial sea salts of different origins for the identification and characterization of MPs. The average abundance of MPs in all commercial brands is < 700 MP/kg and the particle size range between 5.2 mM and 3.8 μm. The most common types of MPs were identified as fragments, fibers, and pellets. By Fourier-Transform infrared spectroscopy (FT-IR), it was found that the MPs in abundance were made of cellophane (CP), polystyrene (PR), polyamide (PA) and polyarylether (PAR). Further, *in vitro* toxicity assessment revealed that HEK-293 cells get detached upon treatment with MPs (MIC-75 μg mL⁻¹). Consequently, the AO/EB dual staining confirmed that the induction and rate of apoptosis were comparatively higher in microplastic treated HEK-293 cells. Taken together, the MPs identified are the origin of anthropogenic derivatives and

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Microbial bio-based polymer nanocomposite for food industry applications

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16.1 Introduction

Nanotechnology refers to the broad field of applied sciences, where manipulation, designing the structure of materials in the nanoscale (10–100 nm) is dealt with. Nanomaterial offers diverse physicochemical properties like the superior surface area to volume ratio, absorption, high stability, thermal sturdiness, and optical properties with many industrial applications. In recent years, nanomaterials are used in fabricating food sensors, food packaging, detection of microbiological contamination in foods, agriculture, and animal feeds. For the past 10 years, numerous nanotechnology-based products came into the market owing to their nanosized features (Silva et al., 2014). Nanotechnology is mostly used in food sectors to prolong the storage life of food produces by nanomaterial-coated packaging systems and to detect the freshness of the sealed food by using nanomaterial sensors (Cerqueira et al., 2014; Dasgupta et al., 2015).

In recent years, several nanomaterials-based research works have been published related to the applications such as water purification through nanofiltration, development

* Authors equally contributed.

மும் செல்வத்திற்கு அனுமதிக்கப் படுகின்றனர். அதாவது 5.30 மணி முதல் இரவு 7.30 மணி வரை இலவச மற்றும் ரூ.100 கட்டணத்தில் தினசரி 2 ஆயிரம் பத்தர்கள் மட்டுமே சாமி தரிசனத்துக்கு அனுமதிக்கப்

பயில் புகழ்தல் மட்டுமே மறு கவாமி சண்முகர் எழுந்தரு ளையில் ஆடிய சிவசூசிகள் பத்தர்கள் வசதிக்காக வலல்த எத்தில் (பூடிபூம்) நேரடியாக ஒளிபரப்பப்படும் என்று கோவில் செயல் அலுவலர் அமரித் தெரிவித்து உள்ளார்.

வைரஸ் பரவலை கட்டுப்படுத்த ஏ.சி.யில் காற்றுச்சீரமைப்பான்

அழகப்பா பல்கலைக்கழக மாணவர்கள் உருவாக்கினர்

காரைக்குடி, செப். 5-
ஏ.சி.யில் வைரஸ் பர வலை கட்டுப்படுத்தும் காற்றுச்சீரமைப்பானை அழகப்பா பல்கலைக்கழக மாணவர்கள் உரு வாக்கி உள்ளனர்.



ஏ.சி.யில் இருந்து வைரஸ் பரவுவதை தடுக்கும் வகையில் காற்று சீரமைப்பான் கருவி துணைவேந்தர் ராஜேந்திரன் முன்னிலையில் செயல் விளக்கம் அளிக்கப்பட்டது.

புற ஊதா கதிர்கள்

அழகப்பா பல்கலைக்கழக இயற்பியல் துறை பேராசிரியர் மற்றும் அறிவியல் கருவி மையத்தின் இயக்குனர் சங்கர நாராயணன் மற்றும் தொழில் முனைவு புத்தாக்க மற்றும் வேலைவாய்ப்பு முனையத் தின் இயக்குனர் முனைவர் இளங்குமரன் ஆகியோர் வழி காட்டுதலில் பயிற்றுனர்கள் அழகுராமன், ஜெயமுருகன் மற்றும் மாணவர்கள் பிரதிஷ், அங்கப்பன், பரணி, படிக்காசு, அழகிரி ஆகியோர் கொரோனா வைரஸ் பர வலை கட்டுப்படுத்தும் வகை யில் ஏர்கண்டிஷனரில் உப யோகப்படுத்தக்கூடிய புற ஊதா கதிர்கள் கொண்ட காற் றுச்சீரமைப்பானை உரு வாக்கி உள்ளனர்.

இதனை நேரில் பார்வை யிட்டு பாராட்டிய அழகப்பா பல்கலைக்கழக துணைவேந் தர் ராஜேந்திரன் கூறியதா வது- உலக சுகாதார நிறுவ னம் மற்றும் பல்வேறு ஆய்வு முடிவுகளின்படி ஏசீசில், இரு மல், தும்மலில் ஏற்படும் நீர் திவலைகள் மூலம் கொரோனா வைரஸ் பரவ வாய்ப்புகள் அதிகம் உள்ளதாக கூறப்படுகி றது. இதனை கருத்தில் கொண்டு மக்கள் நெருக்கம் அதிகம் உள்ள அலுவலகங் கள், வணிக நிறுவனங்களில் கொரோனா தொற்று நோய் பரவுவதை கட்டுப்படுத்த முக கவசம் மற்றும் கிருமிநாசினி பயன்படுத்தப்படுவதுடன் குளிர்சாதன எந்திரங்களை பயன்படுத்தாமல் இருப்பது போன்ற பல்வேறு கட்டுப்பாடுகளை மத்திய-மாநில அரசு கள் அறிவுறுத்துகின்றன. இருப்பினும் நீண்ட கால உப யோகத்தில் குளிர்சாதன எந் திரங்களின் பயன்பாடு பல காரணங்களுக்காக தவிர்க்க முடியாத ஒன்றாகி விட்டது. பாதுகாப்பான முறையில் குளிர்சாதன எந்திரங்களைப் பயன்படுத்த அழகப்பா பல

கலைக்கழக அறிவியல் உபகர ணங்கள் மைய இயக்குனரின் வழிகாட்டுதலின் கீழ் தொழில் முனைவு, புத்தாக்க மற்றும் வேலைவாய்ப்பு முனையத் தின் மாணவர்கள் மற்றும் பயிற்றுனர்கள் அடங்கிய குழு இந்த புதுமையான மற்றும் குறைந்த செலவிலான புற ஊதா சி அடிப்படையிலான காற்றுச்சீரமைப்பானை உரு வாக்கி உள்ளனர். இந்த கரு வியை வழக்கமான குளிர்சா தன எந்திரங்களில் எளிதாக நிறுவ முடியும். கிருமி நாசினி நோக்கங்களுக்காக புற ஊதா சி கதிர்வீச்சு மிகவும் பயனுள் ளதாக இருக்கும் என்று ஆராய்ச்சிகள் நிரூபித்துள் ளன. புற ஊதா சி கதிர்வீச்சு மூலம் டி.என்.ஏ. கட்டமைப் புகள் உடைக்கப்பட்டு பாக்கீ ரியா வைரஸ்கள் மற்றும் கொரோனா வைரஸ்போன்ற ஒற்றை செல் கிருமிகளை நம் பத்தகுந்த முறையில் கொல்ல முடியும்.

குளிர்சாதன எந்திரம்

இந்த காற்றுச்சீரமைப்பா னில் உள்ள எல்.சு.டி. விளக்கில் இருந்து வெளிவரும் குறுகிய அலைநீளம் கொண்ட புற ஊதா சி கதிர்கள் 99.99 சதவீ தம் பாக்கீரியா மற்றும் கொரோனா வைரசை அழிக்கும் ஆற்றல் கொண்டவை. வழக்கமான தொழில் நுட்பங்களை விட புற ஊதா சி எல்.சு.டி.களில் பாதரசம் பயன்படுத்தப்படுவதில்லை. இந்த புதிய காற்றுச்சீரமைப்

பானில் புறஊதா சி ஒளி நன் றாக பாதுகாக்கப்படுவதால் இதுமனிதர்களின் ஆரோக்கி யத்திற்கும் பாதுகாப்பானது. எனவே இந்த புதிய புற ஊதா சி கதிர்கள் அடிப்படையி லான காற்றுச்சீரமைப்பானை பொதுவான இடங்களில் பயன்படுத்தும் குளிர்சாதன எந்திரங்களில் திறம்பட பொருத்தலாம். அழகப்பா பல்கலைக்கழக கொரோனா தடுப்பு நடவடிக்கைகளின் ஒரு பகுதியாக இந்த காற்றுச் சீரமைப்பானை பல்கலைக்கழக துறைகள், அலுவலகங்கள், ஆய்வகங்கள் மற்றும் முக்கிய மான கூட்ட அரங்குகளில் உள்ள குளிர்சாதன எந்திரங் களில் விநைவில் பொருத்த உள் ளோம்.

இதனால் முழு அடைப்பு முடிந்து மாணவர்கள், ஆசிரி யர்கள் மற்றும் பணியாளர் கள் பல்கலைக்கழகத்திற்கு திரும்பும்போது தங்கள் கட மைகளை பாதுகாப்பான சூழ் நிலையில் நிறைவேற்ற இது உதவும். இவ்வாறு அவர் கூறி னார். அப்போது பல்கலைக்கழக பதிவாளர் குரு மல்லேஷ் பிரபு, தேர்வுக்கட்டுப்பாட்டு நெறியாளர் கண்ணப்பிரான், நிதி அலுவலர் கருணாநிதி, பல்கலைக்கழகமருத்துவ அதி காரி ஆனந்தி, அழகப்பா திறன் மேம்பாட்டு திறுவன இயக்குனர் இளங்குமரன், ஆலோசகர் தர்மலிங்கம் மற் றும் பாலகிருஷ்ணன் ஆகி யோர் பங்கேற்றனர்.

University Innovation Cell

Title: Reduction of Glass Waste through Glass Sorter: Paver Block Manufacturing Innovation Training Program

Introduction

Glass waste management is a critical environmental concern due to its non-biodegradable nature and potential for environmental pollution. In response to this challenge, a training program for postgraduate (PG) students focusing on paver block manufacturing has been initiated. This program aims to promote zero waste management initiatives by integrating innovative techniques such as the use of a glass sorter to reduce glass waste.

Utilizing a Glass Sorter for Waste Reduction:

The centre piece of this initiative is the implementation of a glass sorter. This technology efficiently segregates glass waste based on color, size, and type. By sorting the glass, it becomes possible to identify suitable pieces for recycling or repurposing, thus minimizing waste generation.

Grinding the glass waste:

Once sorted, the glass waste undergoes grinding processes. Grinding reduces the glass into smaller particles, facilitating its integration into the manufacturing process of paver blocks. This step not only repurposes the waste but also adds value to the manufacturing process by incorporating recycled materials.

Paver Block Manufacture:

The ground glass waste is incorporated into the production of paver blocks. These blocks serve as a sustainable alternative to traditional construction materials, offering durability and aesthetic appeal. By incorporating recycled glass, the paver blocks contribute to resource conservation and environmental sustainability.

Zero Waste Management Initiatives:

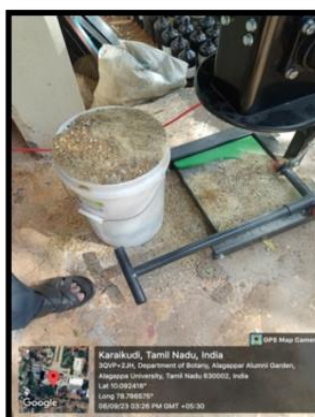
The training program emphasizes zero-waste management principles through practical learning. Participants gain hands-on experience in waste sorting, grinding techniques, and paver block manufacturing. This approach fosters innovation and encourages the development of sustainable solutions to waste management challenges.

Benefits of the Program:

- **Environmental Sustainability:** By reducing glass waste and utilizing recycled materials in paver block manufacture, the program contributes to environmental conservation.
- **Practical Learning:** PG students acquire valuable skills and knowledge through hands-on training, preparing them for future endeavors in sustainable development.
- **Innovation:** The integration of glass sorter technology and waste reduction strategies promotes innovative solutions to waste management.
- **Community Engagement:** By addressing local waste management challenges, the program engages with the community and fosters a sense of environmental responsibility.

Conclusion

The PG students training program focusing on paver block manufacture exemplifies a proactive approach to waste management. By integrating the use of a glass sorter and promoting zero-waste initiatives, the program not only reduces environmental impact but also cultivates innovation and practical learning. Through collaborative efforts, such initiatives can pave the way for a more sustainable future.







ALAGAPPA UNIVERSITY

**(State University | A+ Grade by NAAC (CGPA : 3.64) in the 3rd Cycle | Category - I
University by MHRD - UGC)**

Karaikudi

BIO-PLASTIC CENTRE

Booklet for NAAC SSR

BIO-PLASTIC CENTRE

Dr. A. Arun
Co-Ordinator- UBCC
12.05.2020 Onwards

Initiated commercialization of Institutional R&D outcome – Bioplastic



Ref: BBS/CON/PROJ/2023/01

Date:15-May-2023

CONSULTANCY PROJECT

To

- | | |
|--|---|
| 1. Prof. Mukesh Doble,
Director,
THEEVANAM ADDITIVES &
NUTRACEUTS PVT LTD, IIT MADRAS
RESEARCH PARK,
CHENNAI- 600036. | 2. Prof A. Arun,
Professor and Head,
Department of Microbiology,
Science Campus,
Alagappa University,
Karaikudi ,630003. |
|--|---|

Sub: Looking for Bioplastic - PLA product development based on the consultancy project proposed - Reg:

Dear Prof. Mukesh Doble and Prof. Arun,

Good Wishes.

Continuing our telephone discussion, I am sending this official request for the Research Consultancy.

Bogar Bio Bee Stores Private Limited is involved in offering top-quality products that spell excellence. Bogar Bio Bee Stores Pvt Ltd is ISO 9001-2015, ISO 13485:2016 certified company. Our platform is driven by insightful professionals and Research and Development facility with innovative and inventive products.

Bogar Bio Bee Stores Private Limited wants to do R&D and make products based on your research experience. Hence, we want a consultancy project, especially in Poly Lactic Acid (PLA) product development.

Bogar Bio Bee Stores Private Limited would like to start this consultancy project tentatively from May 2023 and will pay a sum of Rs 7,00,000.00 for six months for doing the PLA work. The instruments at our labs and Alagappa University In-house R&D lab, which will be developed, can be utilized for this consultancy project.

We hope you will consider the offer and await any communication from you.

Thanking you
With Regards



BOGAR BIO BEE STORES PRIVATE LIMITED

TICEL bio park Phase -III, Module No.104, 1st floor, Maruthamalai Road, Coimbatore-641046. Tamil Nadu.

Ph +91 9043755205 Web: www.biobeestore.com Email: info@biobeestore.com

GSTIN:33AAGCB6892G1Z1 | Drug Licence No.: TN/CBS/21B/00037 | TN/CBS/20B/00037

Bogar Bio Bee Stores Pvt Ltd., Coimbatore

Emirates Professor Mukesh Doble from IIT Madras, Chennai, Founding Director, Start-up Company – Theevanam) at IIT Madras Incubation Cell (IITMIC).

Dr. A. Arun, Dept. of Microbiology

PLA (Biodegradable Plastic) Production
7 Lakhs for 6 Months

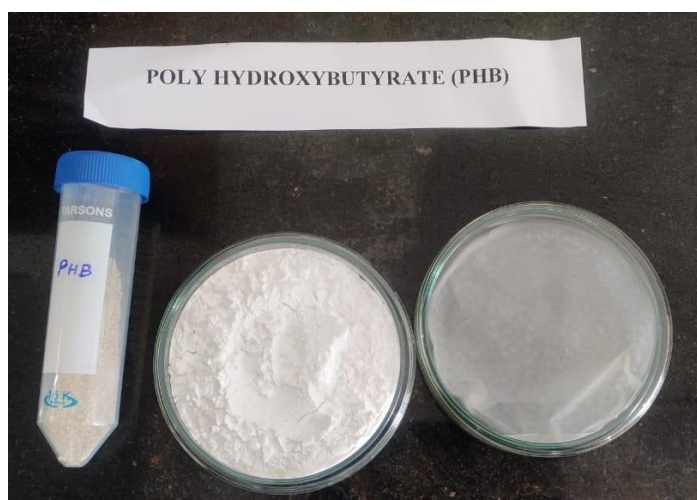
Galaxy Research Technologies, Karaikudi



Galaxy Research Technologies (Consultancy Project) - Rs. 3.6 for 1 Year

Biodegradable plastic (PHB) Produced at Department of Microbiology

Mohanrasu, K., Premnath, N., Siva Prakash, G., Sudhakar, M., Boobalan, T., Arun, A., 2018. Exploring multi potential uses of marine bacteria; an integrated approach for PHB production, PAHs and polyethylene biodegradation. *Journal of Photochemistry and Photobiology B: Biology*, Vol.185, (August 2018), Pages 55-65 (**IF 6.814**), ISSN: 1011-1344. <https://doi.org/10.1016/j.jphotobiol.2018.05.014>.



RUSA 2.0 – Entrepreneur in Residence (EIR) Scheme - Rs. 2.00 L - Ongoing

BIODEGRADATION TESTING BIOPLASTIC FILM

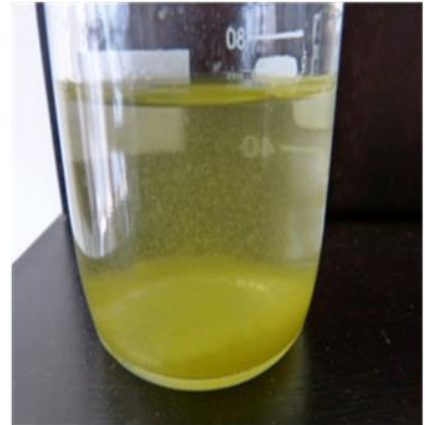
100% Biodegradable in Sea Water



After 30 days

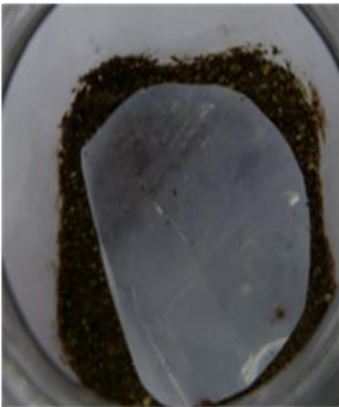


After 60 days



After 140 days

100% Biodegradable in Soil



0 day



After 60 days



After 90 days

Publications related to the proposed work from our Lab (Cumulative Impact factor- 60)

1. Mohanrasu, K., Guru Raj R.R., Dinesh, G.H., Zhang, K., Siva Prakash, G., Song, D., Muniyasamy, S., Pugazhendhi, A., Jeyakanthan, J., Arun, A., 2020. Optimization of media components and culture conditions for polyhydroxyalkanoates production by *Bacillus megaterium*. Volume 271, 117522. Fuel. <https://doi.org/10.1016/j.fuel.2020.117522> (IF – 8.035).
2. Jiang, H., Ding, Y., Liu, J., Arun, A., Pan, L., Song, D., Zhang, K., Li, Y., 2020. Super-Tough Poly (lactic acid) and Sustainable Elastomer Blends Compatibilized by PLLA-*b*- PMMA Block Copolymers as Effective A-*b*-C Type Compatibilizers. Industrial & Engineering Chemistry Research. ACS Publication. <https://doi.org/10.1021/acs.iecr.0c00988> (IF: 4.326).
3. Dinesh, G.H., Nguyen, D.D., Ravindran, B., Chang, S.W., Dai-Viet, N.Vo., Quang-Vu Bach, Tran, H.N., Jothi Basu, M., Mohanrasu, K., Murugan, R.S., Swetha, T.A., Sivaprakash, G., Arokiyaraj, S., Arun, A., 2020. Simultaneous Biohydrogen (H₂) and Bioplastic (Poly-β-Hydroxybutyrate-PHB) Productions under Dark, Photo, and Subsequent Dark and Photo Fermentation Utilizing Various Wastes. International Journal of Hydrogen Energy. ISSN: 0360-3199. (IF: 7.139) <https://doi.org/10.1016/j.ijhydene.2019.09.036>
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Considering the **National need**, specific **new product** / process / **technology** / service **developed** :

- **4 scholars** had visited Tianjin University, China for characterizing their samples and trained up in Advanced Instrumentation Methods.
- Related to **bioplastic R&D 12 research articles in cumulative impact factor of 60**.
- We **prepared Super-Tough Poly (lactic acid)** and Sustainable Elastomer Blends (Published in Industrial & Engineering Chemistry Research. ACS - IF: 3.573).
- ***B. megaterium* isolate produced 5.61 g/L of PHB** (Published in Fuel - IF: 5.578).
- ***M. luteus* produced 11.58 g/L of PHB in batch fermentation** (Unpublished data).



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Tianjin University, China
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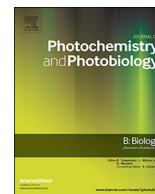
Prof. Mukesh Doble,

IIT-M, Chennai

Publications with international Collaborations

Prof. Kunyu Zhang, China, Prof. Dong Po Song, China and Dr. Sudhakar Muniyasamy, South Africa

1. Mohanrasu, K., Guru Raj R.R., Dinesh, G.H., **Zhang, K.**, Siva Prakash, G., Song, D., **Muniyasamy, S.**, Pugazhendhi, A., Jeyakanthan, J., **Arun, A.**, 2020. Optimization of media components and culture conditions for polyhydroxyalkanoates production by *Bacillus megaterium*. Volume 271, 117522. Fuel. <https://doi.org/10.1016/j.fuel.2020.117522> (IF – 8.035).
2. Jiang, H., Ding, Y., Liu, J., **Arun, A.**, Pan, L., **Song, D.**, **Zhang, K.**, Li, Y., 2020. Super-Tough Poly (lactic acid) and Sustainable Elastomer Blends Compatibilized by PLLA-*b*- PMMA Block Copolymers as Effective A-*b*-CType Compatibilizers. Industrial & Engineering Chemistry Research. ACS Publication. <https://doi.org/10.1021/acs.iecr.0c00988> (IF: 4.326).
3. Mohanrasu, K., Guru, R.R., Dinesh, G.H., Zhang, K., **Sudhakar, M.**, Pugazhendhi, A., Jeyakanthan, J., Kumar, P., Govarthanan, M., **Arun, A.**, 2021. Production and Characterization of biodegradable Polyhydroxybutyrate by *Micrococcus luteus* isolated from marine environment. International Journal of Biological Macromolecules. DOI: <https://doi.org/10.1016/j.ijbiomac.2021.07.029> (IF – 8.025).
4. Mohanrasu, K., Premnath, N., Siva Prakash, G., **Sudhakar, M.**, Boobalan, T., **Arun, A.**, 2018. Exploring multi potential uses of marine bacteria; an integrated approach for PHB production, PAHs and polyethylene biodegradation. Journal of Photochemistry and Photobiology B: Biology, Vol.185, (August 2018), Pages 55-65 (IF 6.814), ISSN: 1011-1344. <https://doi.org/10.1016/j.jphotobiol.2018.05.014>
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6. **Muniyasamy, S.**, Ofosu, O., Thulasinathan, B., Thondi Rajan, A.S., Ramu, S.M., Soorangkattan, S., Muthuramalingam, J.B., **Arun, A.**, 2019, Thermal-chemical and biodegradation behaviour of alginic acid treated flax fibres/ poly(hydroxybutyrate-co-valerate) PHBV green composites in compost medium, Biocatalysis and Agricultural Biotechnology, doi: <https://doi.org/10.1016/j.bcab.2019.101394> (IF: 4.26)



Exploring multi potential uses of marine bacteria; an integrated approach for PHB production, PAHs and polyethylene biodegradation

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PAHs
Biofilm
Polyethylene
Marine
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ABSTRACT

There are copious of bacteria exist in marine environment and it is very important to screen the potential microbes that has the ability to produce biopolymer polyhydroxybutyrate (PHB) as well as polycyclic aromatic hydrocarbons (PAHs) degradation and conventional plastic high density polyethylene (HDPE) biodegradation. Numerous studies have been investigated individually on either one of characteristic feature like PHB production, PAHs and high density polyethylene (HDPE) degradation, but not all together. Hence, in this study, we tried to screen potential marine microbes that have the ability to perform all three features. We have isolated 203 phenotypically different colonies from 19 different sites (marine soil sediments, marine water and oil spilled marine water) which cover the north east to down south seashore regions of Tamilnadu, India. Of the 203 microbial isolates, the best PHB producing (*Micrococcus luteus*), PAHs degradation (*Klebsiella pneumoniae*) and HDPE degradation (*Brevibacillus borstelensis*) microorganisms were identified through 16S rRNA sequencing. Analytical studies confirmed PHB production by fourier transform infrared spectroscopy (FT-IR) and nuclear magnetic resonance (¹H & ¹³C NMR); PAHs degradation by high performance liquid chromatography (HPLC), confocal laser scanning microscopy (CLSM), scanning electron microscopy (SEM); HDPE degradation by CLSM, FT-IR and SEM which cover the spectroscopy studies on biological systems.

1. Introduction

It is hypothesized that the evolution and habitability of our earth starts with microbial origin [1]. Microorganisms are one of the prime biological systems involved in sustainability and maintenance of any given ecosystem with prompt adaptation in accordance to environment and deterioration [2]. Among the various ecosystems, marine ecosystem comprised more of about 178,000 species including 34 phyla [3] that constitutes for nearly 71% of earth surface area [4].

The scientific and technological development in serving the human for modern life has developed lot of environmental problems. The huge amount of non-degradable plastic waste has become a key factor in creating environmental pollution [5]. The usage of non-biodegradable synthetic plastics are creating energy crisis, damage to ecosystem and health issues to the mankind. Synthetic plastic substituted natural supplies in various aspects of day-to-day human life and turn out to be an crucial part of our society [6]. Poly-β-hydroxybutyrate (PHB) well examined biopolymer which could be utilized as a perfect substitute for

synthetic polymers [7,8]. Until few reports are available on marine PHB producing microorganisms [7].

Polyethylene [6] and hydrocarbons [9] are the largest contaminants in marine environments. Marine microbial ecosystem exhibits very high adaptability and tolerance against various physical and chemical conditions [10,11]. The cycling of pollutants in marine ecosystem is carried out by microbial actors at molecular, cellular, community and ecosystem level [12]. Marine bacteria carry wide variability of bioremediation possibility that is both beneficial for environmental and in commercial point of view [13]. The research on bioremediation potential of polyethylene [14], PAHs [15] and bioaccumulation of PHB [16] by the marine microorganism were studied individually. But the combined level of PHB bioaccumulation and potential degradation of PAHs and HDPE by marine microbes were not reported. Based on the involvement of marine microorganisms in PHB production and degradation of PAHs and HDPE, in this study we isolated microbes from 19 different sites (marine soil sediments, marine water and oil spilled marine water) which cover the north east to down south seashore regions of Tamilnadu, India. The potential isolates

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Thermal-chemical and biodegradation behaviour of alginic acid treated flax fibres/ poly(hydroxybutyrate-co-valerate) PHBV green composites in compost medium

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Flax biocomposites
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ABSTRACT

In this study, thermal-chemical and biodegradation behaviour of green composites based on flax fibres untreated and treated with alginic acid treated, and poly hydroxybutyrate-co-valerate (PHBV) were studied under composting conditions. The biodegradability of PHBV composites and neat PHBV were assayed by monitoring CO₂ production from polymeric carbon under controlled aerobic composting conditions as per ASTM D5338 standard. During the biodegradation process, PHBV composites thermal-chemical and morphology properties were characterized by thermogravimetric analysis (TGA), fourier transform infra-red (FT-IR) and scanning electron microscopy (SEM) techniques. The ultimate biodegradation (mineralization) study results showed alginic acid treated flax/PHBV composites has higher rate of degradation than untreated flax/PHBV composite and neat PHBV. TGA analysis indicated that an increased t-onset temperature for alginic acid treated flax fibres/PHBV composites which was mainly due to the influence of 2% sodium alginate treated with flax fibres. FTIR results showed the increased degradation of PHBV composites was due to the hydrolytic chain scission mechanisms influenced by presence of alginic acid and flax fibres as compared to neat PHBV matrix. Morphological SEM analysis showed PHBV composites biodegradation were readily attacked by fungus but rather PHBV degradation by bacteria. This study found that the incorporation of flax fibres into PHBV matrix provides a benefit to the green composites with enhanced biodegradability.

1. Introduction

The growing concern about environmental pollution due to post consumer plastics waste disposal is posing a challenge to industry and academia for the development of eco-friendly and sustainable green materials. Globally, there is much research interest in the area of sustainable biopolymers and biobased materials from bioresources for green manufacturing. Polymer composites based on natural fibres is currently receiving much attention as eco-friendly materials as replacement for synthetic fibres in various industrial sectors applications, such as automotive, construction and packaging applications. This

is mainly attributed favourable properties of the natural fibres such as low density, low cost and specific mechanical strength as well as environmental friendliness, renewability and economic sustainability (Luo and Netravali, 1999; John and Thomas, 2008; Faruk et al., 2012; Mohanty et al., 2002; Mohanty et al., 2018).

Microbial biopolymer mainly produced by microbial fermentation of renewable feedstock or directly extracted biopolymers from biomass are the new generation of materials and their renewability offers an intrinsic neutral carbon and save primary resources (Mooney, 2009; Muniyasamy et al., 2013; Sabapathy et al., 2019). Poly (3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) is a thermoplastic biopolyester produced by

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Biobased Biodegradable Polymers for Ecological Applications: A Move Towards Manufacturing Sustainable Biodegradable Plastic Products

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Abstract

In recent years, the emerging environmental concern for traditional plastic materials has posed a challenge to academia and industries to come up with an alternative eco-friendly material. This is because the post-consumer plastic items are non-biodegradable when disposed in natural environments such as landfill and marine sites. However, these plastics accumulate in these natural environments and create serious pollution that persists to cause environmental damage for decades. In order to address these issues, an innovative global circular economic concept in manufacturing new sustainable green products is currently underway to develop sustainable bioplastic products that will have economic, environment and social benefits. In this chapter the development of biopolymers directly extracted from biomass, monomer production from fermentation and microbial synthesis of biopolymer and their current potential applications are discussed.

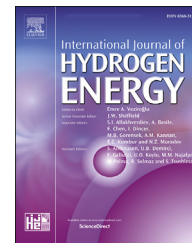
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Simultaneous biohydrogen (H₂) and bioplastic (poly-β-hydroxybutyrate-PHB) productions under dark, photo, and subsequent dark and photo fermentation utilizing various wastes

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 Soon Woong Chang ^d, Dai-Viet N. Vo ^g, Quang-Vu Bach ^h,
 Hai Nguyen Tran ⁱ, M. Jothi Basu ^j, Kulanthaisamy Mohanrasu ^{a,b},
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Abbreviations: Poly-β-Hydroxybutyrate, (PHB); Rice Husk Hydrolysate, (RHH); Rice Straw Hydrolysate, (RSH); Dairy Industry Wastewater, (DWW); Rice Mill Wastewater, (RWW); Dark Fermentation, (DF); Photo Fermentation, (PF); Standard Temperature and Pressure, (STP); Volatile Fatty Acids, (VFAs); Hydrogen Yield, (HY); Poly Hydroxy Alkanoate, (PHA); Photo Fermentative Hydrogen Production, (PFHP); Nitrogen Limited Minimal Synthetic, (NLMS); National Centre for Biotechnology Information, (NCBI); Basic Local Alignment Search Tool, (BLAST); Oxidation-Reduction Potential, (ORP); Chemical Oxygen Demand, (COD); Biological Oxygen Demand, (BOD); Ammonia-Nitrogen, (NH₄-N₂); Fourier Transform Infrared, (FTIR); Red, (R); Green, (G); Tri- Carboxylic Acid, (TCA); Purple Non-Sulfur, (PNS); Dark Fermented Effluent, (DFE); Dark Fermented Hydrolysate, (DFH); Substrate, (Sub.); Concentration, (Conc.); Fermentation, (Fer.); Autoclaved, (Auto.); Unautoclaved, (Unauto).

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Production and characterization of biodegradable polyhydroxybutyrate by *Micrococcus luteus* isolated from marine environment

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Marine bacteria
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ABSTRACT

Marine microorganisms are reported to produce polyhydroxybutyrate (PHB) that has wide range of medical and industrial applications with the advantage of biodegradability. PHBs are synthesized as an energy and carbon storage element under metabolic pressure. The scope of this work is enhancing PHB production using marine microbial isolate, *Micrococcus luteus* by selectively optimizing various growth conditions such as different media components and growth parameters that influence the cell growth and PHB production were sampled. *Micrococcus luteus* produced 7.54 g/L of PHB utilizing glucose as a carbon source and ammonium sulphate as a nitrogen source with maximum efficiency. The same optimized operational conditions were further employed in batch fermentation over a time span of 72 h. Interestingly higher cell dry weight of 21.52 g/L with PHB yield of 12.18 g/L and 56.59% polymer content was observed in batch fermentation studies at 64 h. The chemical nature of the extracted polymer was validated with physio-chemical experiments and was at par with the commercially available PHB. This study will spotlight *M. luteus* as a potential source for large-scale industrial production of PHB with reducing environmental pollutions.

1. Introduction

An exponential surge of human population and poor waste management practices have resulted in the accumulation of a large volume of environmental pollutants and currently several researchers solving the problems [1–5]. The non-degradable wastes include plastics that are highly destructive to the environmental quality [6–8]. Conventional degradation techniques of plastics are dawdling and most of them release harmful toxins such as dioxins, furans, mercury and polychlorinated biphenyls to the environment [9,10]. Mounting apprehensions about environmental pollution from the mammoth accumulation of plastics in the ecosystems has highlighted the research requirement for developing bioplastics such as polyhydroxyalkanoates (PHAs) that are environmentally friendly [10,11]. PHAs are the polymers accumulated by bacteria as an

energy storage molecule under stress conditions such as with increased carbon source, and reduced oxygen, phosphorus and nitrogen [13]. Under these stress conditions, the carbon flow is channeled to PHA synthesis instead of being used for overall cell functions [14]. The most commonly deliberate examples of PHAs include poly(3-hydroxybutyrate-co-3-hydroxyvalerate) and polyhydroxybutyrate (PHB). The PHAs synthesized by micro-organisms are known to be biocompatible, non-toxic, biodegradable, thermoplastic, insoluble in water, and have characteristics (e.g., tensile strength) an analogous to synthetic plastic sources like polypropylene and polyethylene [15,16]. Hence, they serve as an excellent replacement for conventional plastics with additional benefit of being completely and quite rapidly degradable in both aerobic and anaerobic conditions by the action of microorganisms [17].

Marine environment provides a source of microorganisms with

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Extraction of microplastics from commonly used sea salts in India and their toxicological evaluation

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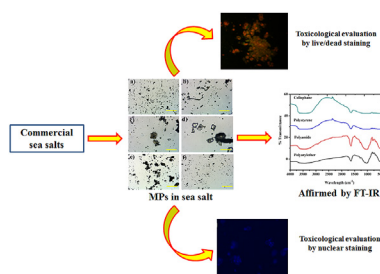
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HIGHLIGHTS

- Ten brands of commercial sea salts of different origin for the identification and characterization of MPs.
- The average abundance of MPs are <700 MP/kg with particles size ranging between 3.8 and 50.2 μm.
- Cellophane (CP), polystyrene (PR), polyamide (PA) and polyarylether (PAR) were identified from the salts.
- Dual and nuclear staining confirmed that the induction of apoptosis in microplastic treated HEK-293 cells.

GRAPHICAL ABSTRACT



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ABSTRACT

Microplastics (MPs) are one of the marine debris, accumulated in the ocean as a result of the successive breakdown of a large piece of plastics over several years. MPs are about less than 5 mM, have a detrimental impact on marine organisms/products (seafood/sea salts) and therefore they are considered as a global environmental pollutant. The occurrence and impact of MPs in commercial sea salts that are consumed by humans are not well studied so far. In the present study, we attempted to characterize and evaluate the *in vitro* toxicity of isolated MPs. Here, we have used ten brands of commercial sea salts of different origins for the identification and characterization of MPs. The average abundance of MPs in all commercial brands is < 700 MP/kg and the particle size range between 5.2 mM and 3.8 μM. The most common types of MPs were identified as fragments, fibers, and pellets. By Fourier-Transform infrared spectroscopy (FT-IR), it was found that the MPs in abundance were made of cellophane (CP), polystyrene (PR), polyamide (PA) and polyarylether (PAR). Further, *in vitro* toxicity assessment revealed that HEK-293 cells get detached upon treatment with MPs (MIC-75 μg mL⁻¹). Consequently, the AO/EB dual staining confirmed that the induction and rate of apoptosis were comparatively higher in microplastic treated HEK-293 cells. Taken together, the MPs identified are the origin of anthropogenic derivatives and

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Microbial bio-based polymer nanocomposite for food industry applications

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16.1 Introduction

Nanotechnology refers to the broad field of applied sciences, where manipulation, designing the structure of materials in the nanoscale (10–100 nm) is dealt with. Nanomaterial offers diverse physicochemical properties like the superior surface area to volume ratio, absorption, high stability, thermal sturdiness, and optical properties with many industrial applications. In recent years, nanomaterials are used in fabricating food sensors, food packaging, detection of microbiological contamination in foods, agriculture, and animal feeds. For the past 10 years, numerous nanotechnology-based products came into the market owing to their nanosized features (Silva et al., 2014). Nanotechnology is mostly used in food sectors to prolong the storage life of food produces by nanomaterial-coated packaging systems and to detect the freshness of the sealed food by using nanomaterial sensors (Cerqueira et al., 2014; Dasgupta et al., 2015).

In recent years, several nanomaterials-based research works have been published related to the applications such as water purification through nanofiltration, development

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