



2019 Sustainability Report



**SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY**

www.sathyabama.ac.in

|

Tamilnadu, India

Preamble

The term sustainable development and sustainability is gaining increased attention in recent years. It has become the most frequently discussed topic in the last few decades. The report by the Brundtland Commission developed the most widely used and popular definition of sustainable development as “development which meets the needs of current generations without compromising the ability of future generations to meet their own needs”. Every developmental initiative of Sathyabama Institute of Science and Technology focuses on sustainability. This Sustainability Report is an evidence of the Institution’s commitment towards achieving sustainable development.

The report is aimed at stakeholders who have an interest in our sustainability performance, including professional and academic staff, students, local communities and local businesses. It reveals the institutional approach and commitment to sustainability. This report focuses on our sustainability initiatives for the year 2019.

Message



Dr. MARIAZEENA JOHNSON

B.E., MBA., M.Phil., Ph.D.

Chancellor



Dr. MARIE JOHNSON

B.E., MBA., M.Phil., Ph.D.

President

We are very happy to publish the Institution's Sustainability Report, which provides a brief review of the work for the year 2019.

Sustainability is gaining increased attention in recent years. Traditionally, Higher Educational Institutions are expected to play a major role in educating the youth and nurturing future leaders and citizens. But now the role of Higher Educational Institutions is drastically changing and moving towards addressing the societal challenges. Since the evolution of the Millennium Development Goals and the Sustainable Development goals, sustainable growth has become a major concern for administrators and leaders. Sathyabama strives to acknowledge and adopt the concept of sustainability in its academic, research and developmental pursuits.

Our Institution strictly adheres to eco-friendly and sustainable development practices and advocate environmental protection initiatives like use of alternative and renewable energy, recycling of waste, reduction of plastic usage, reduction in carbon emissions, reduction of food wastage and adoption of organic farming. The staff and students of our institution have understood their role in building a sustainable community and actively participate in all our environmental protection initiatives.

We are very happy that we are able to make significant progress toward the Sustainable Development Goals proposed by Agenda 2030 that aims to protect people and the planet.

Foreword

Sathyabama is known for its commitment to societal development, apart from its academic and research excellence. It is bestowed with state of the art infrastructure and world class research facilities and recognized as one of the top higher educational institutions both at national and international level.

Sustainable development emphasizes on economic progress with due recognition on environmental and societal aspects. Any advancement is considered to be real only if it is not made at the cost of the environment. It is high time that we all stop our unsustainable practices and start getting involved in efforts to preserving natural resources. Our Institution is one of the fore runners in adopting innovative practices to achieve sustainable development.

Academic and Research initiatives of the Institution are focused on the achievement of the sustainable development goals like eradicating poverty and hunger, developing good health and well-being, creating access to clean and affordable energy, combating climate change, reducing economic inequalities, promoting gender equality and developing sustainable community. Our Institution's curriculum is designed in such a way that sustainable development is the core of it. We have dedicated Research Centres like Centre for Energy Research, Centre for Climate Change Studies, Centre for waste Management, Centre for Ocean Research and Centre for Drug Discovery and Development that are working towards the achievement of United Nation's Sustainable Development Goals -Agenda 20230.

We are happy to publish this report that publicizes our Institution's efforts to build a safe, prosperous, resilient and sustainable community.

Dr. T. SASIPRABA, M.E., Ph.D.
VICE CHANCELLOR

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S. NO.	Contents	PAGE NO.
A	About SATHYABAMA	1
B	Rankings and Ratings	1
C	Sathyabama's Sustainability Approach And Perspective	3
D	Research at Sathyabama	4
E	Research focusing on Sustainable Development Goals	5
F	Society and Community	7
1	SDG 1- NO POVERTY	12
1.1	Admission of students belonging to lower income group with full scholarships	12
1.2	Relationship with Adopted Schools And Villages	13
1.3	Summer Camp and "My Saturday University"	14
1.4	Goals and Achievements	14
1.5	Adoption of villages	15
2	SDG 02 ZERO HUNGER	17
2.1	Research Contribution	17
2.2	Training Programmes	18
2.3	Outreach Programmes	18
2.4	Food Distribution during Natural Disasters:	18
2.5	Women Empowerment and Eradication of Hunger	19
3	SDG 03 GOOD HEALTH AND WELL-BEING	21
3.1	Research and Publications	21

S. NO.	Contents	PAGE NO.
3.2	Programmes	21
3.3	General Hospital and Dental Hospital	21
3.4	CDDD PUBLICATION in 2019 for SDG3- No's (10)	29
4	QUALITY EDUCATION	31
4.1	Adoption of Schools	32
4.2	Adopted Schools and their requirements satisfied for the period 2019	34
4.3	Skill Development Centre	35
4.4	Centre for Professional and Career Advancement	35
4.5	Guidance for Higher Studies	36
4.6	Jeppiaar IAS Academy	36
5	GENDER EQUALITY	37
5.1	Aims and Goals	39
5.2	Seminars and Workshops	40
5.3	Gender Ratio among Scholarship Students	41
6	CLEAN WATER AND SANITATION	42
6.1	Ensure availability and sustainable management of water and sanitation for all	42
6.2	Prominent initiative taken by the Institution –Establishment of Sewage Treatment Plant	43
6.3	Research publications	45
6.4	Innovation which are strongly supporting SDG 6	47
6.5	Patent Filed during the Year 2019 related to SDG 6	49

S. NO.	Contents	PAGE NO.
7	AFFORDABLE CLEAN ENERGY	52
7.1	Global Scenario in Clean Energy	52
7.2	India's Performance in Clean Energy	54
7.3	Status on the Clean Energy Programme at Our Institute	55
7.4	Publications	60
7.5	Research Collaboration	61
8	DECENT WORK AND ECONOMIC GROWTH	62
8.1	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	62
8.2	Graduate Employability	63
8.3	Study Programmes	63
8.4	Informal Student employment initiatives	65
8.5	Integration of persons with disabilities	66
8.6	Educational equity and community Development	66
8.7	Strategy for Economic Empowerment	66
9	INDUSTRY INNOVATION AND INFRASTRUCTURE	68
9.1	Centre of Excellence for Collaborative Product Design and Development (CPDD)	69
9.2	Infrastructures for Innovations	71
9.3	3 Industry Institute Interaction Cell	74
9.4	Executive Development Program	74

S. NO.	Contents	PAGE NO.
10	REDUCED INEQUALITIES	75
10.1	Introduction:	75
10.2	Goals	75
10.3	Scholarship for Disabled Students	76
10.4	Scholarship for Meritorious Students from Socially and Financially Poor Background.	78
10.5	Arrangement With Global Network Equality :(Prisoners Welfare)	78
10.6	Facilities Offered	79
10.7	Support for Excellence	79
10.8	Grievance Cell	80
10.9	Placements for the Disabled	80
11	SUSTAINABLE CITIES AND COMMUNITIES	81
11.1	Leading by example , we provide a sustainable campus	81
11.2	Contribution to Sustainable development of city	82
11.3	Centre of Excellence in Urban Climate and Built environment	82
11.4	Capacity building programs	83
11.5	Sustainability as an integral part of Academic learning	84
11.6	Yearly Academic exercises	85
12	RESPONSIBLE CONSUMPTION AND PRODUCTION	88
12.1	Objective 1: Decoupling environmental degradation from economic growth.	88

S. NO.	Contents	PAGE NO.
12.2	Abstract of the Invention	91
12.3	Abstract of the Invention	92
12.4	Abstract of the Invention	93
12.5	Objective 2: Other Waste to Valuable Material Recovery technologies/processes/products developed in the Centre applying life cycle thinking.	93
12.6	Objective 3 Sizing opportunities for creation of new jobs and poverty eradication	99
12.7	Conference/Awareness Program/Workshop/ Training Program/ Seminar Organized	99
12.8	Societal outreach program	103
12.9	Memorandum of Understanding	105
13	CLIMATE ACTION	108
13.1	Who we are	108
13.2	Research Areas	109
13.3	Coastal Ecosystem Conservation	115
13.4	Teaching and Learning	117
13.5	Research Funding	117
13.6	Publications	119
13.7	Book/Book Chapter	119
13.8	Launch of MERC and CMSP	120
13.9	Sathyabama Marine Research Station	120
13.10	Outreach Programme	121
13.11	MoUs	121

S. NO.	Contents	PAGE NO.
14	LIFE BELOW WATER	123
14.1	Reduce Marine Pollution	123
14.2	Protect and Restore Ecosystems	125
14.3	Reduce Ocean Acidification	126
14.4	Sustainable Fishing	128
14.5	Conserve Coastal and Marine Areas	129
14.6	End Subsidies Contributing to Overfishing	130
14.7	Increase Scientific Knowledge, Research and Technology for Ocean Health	130
15	LIFE ON LAND	135
16	PEACE, JUSTICE AND STRONG INSTITUTIONS	139
16.1	Access to Justice:	146
17	PARTNERSHIPS FOR THE GOALS	146
17.1	Research Collaborators at National level	146
17.2	Internationalization at Sathyabama	147
17.3	Centre for Academic Partnership and International Relations	147
17.4	International Alliances and Collaboration	148
17.5	Erasmus Plus-International Credit Mobility Programme	149
17.6	Mevlana Exchange Programme	150
17.7	Visiting International Professors	151
17.8	Indonesian delegation visit to our institution	151

S. NO.	Contents	PAGE NO.
17.9	FICCI Higher Education Delegation to South Korea	153
17.10	International Research Collaborations	154
17.11	Post-Doctoral Fellowships/Recognitions by Faculty and Students	155
17.12	Faculty Exchange/Research Programmes 2019	159
17.13	Outcome of Collaborative Research	161

A ABOUT SATHYABAMA

Sathyabama Institute of Science and Technology is one of India's premier Academic and Research universities that offers multi-disciplinary academic programmes in various fields of Engineering, Science, Technology, law, Dental Science, Pharmacy, Nursing, and Management. It is established under Sec.3 of UGC Act, 1956 and is been Accredited with 'A' Grade by the National Accreditation and Assessment council. The Institution persistently seeks and adopts innovative methods to improve the quality of higher education and is responsive to the changes taking place in the field of education on a global scale. This glorious Institution is functioning under the dynamic leadership of Dr. Mariazeena Johnson, Chancellor and Dr. Marie Johnson, President.

B. Rankings and Ratings

Sathyabama's standing in rankings and ratings are excellent at National and International level. The Institution has been ranked in 41st position among the Institutions in India by the National Institutional Ranking Framework (NIRF), Government of India for the year 2019. Sathyabama is ranked one among the top 50 Universities for the last four consecutive years. Times Higher Education has ranked Sathyabama among the top Institutions worldwide. It is also been placed in good positions in the Times Higher Education's Subject Ranking for Engineering and Physical Sciences, Emerging Economies Universities Ranking and Young Universities Ranking, for the year 2019.

Sathyabama Institute of Science and Technology is positioned in 51-55 ranks among the Indian Institutions by QS-India Ranking 2020. Sathyabama is awarded with four star ratings for Excellence by Quacquarelli Symonds (QS) and has received the maximum five star ratings for Teaching, Inclusiveness and Facilities and four star ratings for Employability and Innovation. QS I- Gauge, a rating for Indian Universities by QS has conferred Diamond Ratings on Sathyabama in recognition of the Institution's excellence in various parameters including Teaching and Learning, Research, Facilities, Entrepreneurship and Employability. Recently the Institution has been ranked in 401-450 position by QS Asia Rankings 2020.

India Today has ranked Sathyabama in 23rd position among the Top Institutions in India; Times Engineering has given the 3rd rank for Sathyabama among the top Private Engineering Institutions in India and 11th rank among the top Engineering Institutions in India for the year 2019. The WEEK Magazine has ranked Sathyabama in 9th position among the Universities in India and 5th among the Private Universities in south zone for the year 2019.

Sathyabama has been conferred with 12B status by University Grants Commission which has made the Institution eligible to receive assistance from Central Government to undertake more sponsored research projects.

Schools/Department/Courses

There are 8 Schools namely,

- School of Computing,
- School of Electrical and Electronics,
- School of Mechanical Engineering,
- School of Bio and Chemical Engineering,
- School of Building and Environment,
- School of Management Studies,
- School of Science and Humanities
- School of Pharmacy
- School of Nursing
- School of Dental Science
- School of Law

Sathyabama faculties have reached milestones in publishing high impact factor journals. The Institution has around 16,000 Research publications Indexed in Scopus and Web of Science databases to its credit and the H -index of the Institution is 62. More than 300 Joint Publications are made as the outcome of the joint research with International Research Organizations and Universities. Sathyabama's commitment to research can also be well understood by the number of patents granted for the innovative products and designs. The Institution has 80 patents to its credit for the year 2019-20 and waiting for the grant of more patents as it has filed for 200 more patents.

C. SATHYABAMA'S SUSTAINABILITY APPROACH AND PERSPECTIVE

Teaching and Learning

Sustainability forms the core of teaching and the notion of sustainable development is instilled in the students. Students are educated about the sustainability issues and a sense of responsibility is created.

Sathyabama is committed to providing a quality education to students to develop them as responsible citizens who are concerned about their environment. We design our curriculum with adequate emphasis on environmental education. Subjects relating to sustainable development are included in the curriculum of all branches of studies, ensuring that all of our students are groomed as professionals who follow sustainability principles in their professional life.

Sustainability in the curriculum

To have sustainability principle inbuilt in the curriculum the following subjects are included in the curriculum of the University.

- Green computing for Computer science students
- Energy Engineering
- Environmental impact assessment
- Environment pollution control
- Disaster management
- Water resources engineering
- Air and noise pollution
- Ground water engineering
- Solid waste management
- Environmental planning and design
- Wind and solar energy
- Health informatics
- Environmental science and engineering
- Environmental biotechnology
- Biosafety, bioethics and IPR
- Irrigation engineering
- Energy and environmental management
- Sustainable architecture

D. Research at Sathyabama

Sathyabama Institute of Science and Technology is one of the Academic Institutions that gives more emphasis to research as it is aware of the significance of research for sustainable growth and development. To address the global challenges with respect to social, economic and environmental issues, the Institution is involved in breakthrough research and innovation in the thrust areas of Science and Technology.

Academic research is considered to be very important to offer solutions to the problems encountered by the Industries. Having understood the need for sharing knowledge between Industries and Universities, Sathyabama collaboratively work with many of the industries and the fruit of the synergistic effort are enjoyed by the Institution, Industry and Society.

Quality education and research are the twin objectives of the Institution that goes hand in hand. It has made huge investments in building research infrastructure, which is indication of its commitment to research. Sathyabama has 2 research parks namely International Research Centre and Col. Dr.Jeppiaar Research Park to translate innovations into product and technology.

These 2 research parks houses research centres carrying out research on almost all the major areas of science and Technology. These centres include

- Centre for Nanoscience and Nanotechnology
- Centre for Energy Research
- Centre for Ocean Research
- Centre for Space Technology
- The Centre for Bioresource Research and Development
- Centre for Laboratory Animal Research
- Centre for Climate Change Studies
- Centre for Drug discovery and development
- Centre for Earth and Atmosphere Science
- Centre for Remote Sensing and Geoinformatics
- Centre for Robotics and Automation
- Centre for Quality Assurance and Non-Destructive Evaluation
- Centre for Waste Management

E. Research focusing on Sustainable Development Goals

Research at Sathyabama addresses the Sustainable Development Goals of Agenda 2030, which requires the participation of individuals, institutions, countries and Governments in creating a better world free from poverty, hunger, health issues, inequalities, and providing access to quality education, access to clean water and sanitation, access to affordable and clean energy.

- Research relating to the Sustainable Development Goal –SDG 7, addressing the issue of Affordable and Clean Energy is undertaken by the Centre of Excellence in Energy Research funded by MHRD, working towards finding sustainable solutions to the need for energy. This Centre is focussing on research in energy storage and sustainable energy conversion materials, to address the challenges in the energy technologies that strive to fulfil the needs of increasing demand for energy, without affecting environment and due concern for reducing the carbon print.
- Centre for Nanoscience and Nanotechnology focuses on research relating to nanomaterials, nanotechnology, nanocomposites, nanoelectronics, nanofabrication to develop clean, affordable, and renewable energy sources or develop products that consumes less energy and cause less environment pollution.
- Centre for Climate Change Studies focuses on research addressing the most important Sustainable Development Goal –SDG-13 on Climate Change along with SDG 14-Life below Water. This Centre is involved in several key projects that assess the impact of global climate change on marine organisms and ecosystems like Coral reefs, Sea grass meadows, Intertidal zones, Mangrove ecosystem etc. through long term monitoring of selected coastal sites.
- Research in Mariculture, Marine Technology and Engineering, Marine Ecology, Marine Nanotechnology, Marine Biotechnology, and Marine Education is the focus of the Centre for Ocean Research which is working towards SDG 14
- Research in the area of waste management, which works on the 3 R concepts-Reduce, Reuse and Recycle is undertaken by the Centre for Waste management at Sathyabama. This Centre, which is working towards the achievement of SDG 12-Responsible

consumption and production and SDG13, has come out with a biodiesel from waste cooking oil and bio fertilizers from food waste.

- Research to discover novel drugs to fight against life threatening infectious diseases including tuberculosis(TB), Acquired Immuno Deficiency syndrome (AIDS), Dengue and non-infectious diseases including cancer, diabetes etc., which is addressing the SDG-3 Good Health and Well-being is the focus of Centre for Drug Discovery and Development.
- Research facilitating resilience and adaptive capacity to climate related hazards, disaster preparedness against flood related disasters through remote sensing and geoinformatics, addressing SDG 13. Centre for Remote-sensing and Geo-informatics is involved in the research relating to forecasting of weather and climate to meet the exigencies of the threats due to natural calamities and manmade deterioration of the environment.

MARINE RESEARCH STATION

Apart from the Research Centres within the campus, Sathyabama Institute of Science and Technology has established a new Marine Research Station at Rameswaram to encourage research on cutting-edge marine ecology and climate change. The research station would be helpful to “conduct and organize studies related to the coastal and marine biodiversity conservation, and to understand the impact of anthropogenic stressors on the marine ecosystems and associated organisms in the Gulf of Mannar and Palk Bay region. This initiative is successful with the support of the state forest departments, state and central government universities and institutions, marine police, fishery department officials, NGO’s and coastal communities and create awareness among youths towards marine conservation.

Publications and Patents

The Institution has around 14,000 Research publications Indexed in Scopus and Web of Science databases to its credit and the H –index of the Institution is 65. More than 300 Joint Publications are made as the outcome of the joint research with International Research Organizations and Universities. Sathyabama’s commitment to research can also be well understood by the number

of patents granted for the innovative products and designs. The Institution has 80 patents to its credit and waiting for the grant of more patents as it has filed for 200 more patents.

F. SOCIETY AND COMMUNITY

F.1 Sustainable Community

Sathyabama Institute of Science and Technology is involved in community development initiatives that contribute positively to the development of sustainable community. It is playing a vital role in developing a sustainable community

- where the needs of everyone in the community are met and people feel safe, healthy and happy and the prosperity jointly enjoyed
- Where the needs are met while ensuring that adequate resources are available for future generations.
- where the environment is appreciated, protected and damage to the environment is minimised
- Where the employment opportunities are growing and working lives are more rewarding

It is working to achieve the following goals

- Clean air and water and nutritious food for everyone
- Protection of ecosystems and biological diversity
- Conservation of water, land, energy, reduction, reuse and recycling of waste.

To pursue these goals, the Institution:

- Use appropriate technology to minimize emissions and pollution
- Use of renewable energy
- Advocates green concepts like organic farming
- Minimize waste
- Avoid usage of plastics
- Advocate Plantation drive

- Advocates mass transportation
- Advocates the usage of bio-fuel and bio-fertilizers
- Promotes eco-conscious and eco-friendly initiatives

F.2 Participation in government Initiatives

The Faculty members and the Research Scientists of Sathyabama are actively participating in Unnat Bharath Abhiyan, a Government of India's initiative to develop villages by providing technical solutions to their problems. Sathyabama has adopted 5 villages and helped them in solving some of their issues by providing technical solutions, which are purely the outcomes of the research.

F.3 Environment Consciousness Initiatives of the Institution for promoting sustainable development

F. 4 Carbon Neutrality

Only the University buses are allowed inside the campus, which is the only mass transit system. No private vehicles of staff or students are allowed inside the campus, and hence the pollution is almost nil. More trees are scheduled to be planted in future through eco club and a separate land space is allotted to encourage farming.

F.5 Reduction of carbon footprint

At Sathyabama, all the possible actions that produce greenhouse gases are identified and monitored. Efforts are taken to reduce the usage of fossil fuel. One notable initiative is usage of bio-fuel for running some of the Institution's buses. In fact, the bio-fuel is a research outcome of our Centre for Waste Management that adopts innovative technologies for developing cleaner and greener environment. Bio-fuel/bio-diesel is produced from the waste cooking oil generated from the institution's huge cooking facility. The vegetable waste generated after cooking is also effectively converted into bio fertilizer.

This Centre conducts several programmes to students and public to create awareness about waste segregation and management.

F.6 Water consumption

Students and staff of the Institution are instructed to use minimum water and avoid wastage of water. Water saving taps are fitted in rest rooms, wash basins and in student hostels.

F.7 Recycling of waste water

The Institution has a Sewage Treatment Plant that recycles the waste water. The contaminants are treated and reduced to safe level according to the standards of environment agency and removed. The purified water is used for flushing in toilets and watering the plants in the garden.

<https://www.sathyabama.ac.in/campus-life/stp-plant>

F.8 Transportation

Sathyabama advocates mass transportation to reduce carbon emissions and carbon foot print in the environment. The Institution has around 150 buses used for the commutation of staff and students to and from the Institution. It is compulsory for the students to use the Institution run buses. This environmental conscious initiative not only reduces the cost of transportation, but contributes to the reduction in air pollution to a very large extent.

<https://www.sathyabama.ac.in/campus-life/transport-facility>

F.9 Reduction of food waste

The Institution has very big cooking facility that prepares food for around 12000 people. Effective measures are taken to minimize and avoid food waste. One Unique feature of Sathyabama is, anyone visiting the Institution can have food at the Institution's mess free of cost. Moreover as a philanthropic act, the Institution provides food to hundreds of children, old people and destitute women living in the nearby community. This is one small CSR effort of the Institution to feed the hungry mouths.

F.10 Plastic Reduction

Usage of plastic is minimized in the campus. Drinking water coolers are installed at accessible places for students and staff. Usage of polythene covers, plastic water bottles and plastic cups are avoided. Reusable plastics are responsibly used and recycled.

F.11 Supplier evaluation

Responsible consumption-behaviour is promoted in the Institution. An item will be purchased only after ruling out the possibility of repair and reuse. Purchasing will be approved from a particular supplier, producer, manufacturer and distributor only if the green standards are satisfied by them.

F.12 Training for staff and students

Staff members and students of the Institution are given adequate training to learn and follow sustainable practices. No initiative of the Institution can be successfully implemented without the active participation of the staff.

F. 13 Food wastage

University is taking measurable initiatives towards reduction of the food and energy wastage in the campus. Planning and monitoring committee suggestions of the University are helping time and again for waste management; effective power supply management is one such example. Bio degradable and non-bio degradable wastes are segregated separately in the campus and bio degradable wastes are used as food for cattle and used as manure for the plants and trees. Non bio degradable wastes are disposed through the waste disposal adopted through Chennai Metropolitan garbage cleaning methods. Paperless University will be the game changer towards boosting up objective of the environmental friendly campus.

G SUSTAINABLE DEVELOPMENT GOALS

In 2015, 193 Nations agreed with the United Nation that they can change the world for the better by eradicating poverty and hunger, promoting good health and quality education, promoting gender equality, promoting access to clean water and clean energy, taking actions to combat climate change, protecting life below water and life on land, Promoting peaceful and inclusive societies for sustainable development and strengthening the means of implementation and development through global partnerships for sustainable development.



SATHYABAMA'S CONTRIBUTION TOWARDS SUSTAINABLE DEVELOPMENT GOALS

Sathyabama Institute of Science and Technology support the implementation of every SDG, through learning and teaching, research and organizational governance.

SDG 1- NO POVERTY



1.1 Admission of students belonging to lower income group with full scholarships

Sathyabama aims at creating a society where all are employed and poverty is eradicated. Sathyabama believes that education is an instrument to remove poverty. Sathyabama has a reputation as one of the big universities in India. It is a prestigious institute and the Placement cell of Sathyabama have never fallen short of their goals in placing the students who have passed out. A strong Alumni is one of our prides. Every year, we offer admissions to around 500 students, from very poor background, in various streams in our university including, Engineering, Arts, Science, Law and Management. While it is very difficult to select the actual needy, we have tied up with NGO's like Agar am, Maryam, Ability, etc., who help us find the truly deserving students from very low economic background.

The Institution not only provides the fee waiver to these students, but also provides food and on campus accommodation free of cost to enable them to complete their studies. Performance of the students receiving scholarships, are monitored and the students who need special attention are given the additional support. They are given all the support needed to develop them into qualified graduates with employability skills. These students earn their degree and get placed in prestigious organizations, taking their family and their society up as they grow.



Anbu Scholarship Students-2019

1.2 RELATIONSHIP WITH ADOPTED SCHOOLS AND VILLAGES

Sathyabama has adopted 21 government schools and 5 villages in the neighborhood. These schools have children from very poor background and some of the schools lack basic facilities. Sathyabama has always provided all that those schools need, starting with Laptops, to Speakers, OHP's, CCTV, Television sets, printers. Sathyabama has also played an important role in inspiring the students.

When these students visit the college, be it for their summer camp, or for the “ My Saturday academy”, where they visit the university every third Saturday, just to get to see the laboratories, use the computer lab, and get a feel of how college would be. This is just to inspire them to study well and the assurance that if they get good marks in their board exams, they can study free of cost in this prestigious university, where even hostel and food facilities are offered free. It is a dream come true for many and hence they are inspired to study well and pull their families out of poverty.

1.3 SUMMER CAMP AND “MY SATURDAY UNIVERSITY”

The Adopted schools have summer camps for at least 5 days every summer and food snacks and transportation is provided to all the kids who attend. These kids also come to the University campus, for another activity called, “My Saturday University”, which gives them a glimpse of University life and they are also picked up from their respective schools and breakfast lunch and snacks are given. Summer camp is also held for the kids of the work force, teaching and non-teaching staff, every year and they are also given special food and lots and lots of goodies at the end of the camp. The Women Empowerment Bureau always arranges many training programs and all the women who come to the University campus are always given good food.

In fact, Sathyabama has a reputation for the quality and the taste of the food served in the campus.



1.4 GOALS AND ACHIEVEMENTS

The goal of Sathyabama’s CSR arm was to adopt at least 20 government schools and 10 villages. We have till date adopted 21 government schools and 5 villages. Living in a hunger and poverty free society has been Sathyabama’s dream. Our founder Chairman Dr. Col Jeppiaar, had made a mission of feeding anyone who visits the college and this tradition has been carried on till date.

1.5 Adoption of villages

Sathyabama Institute of Science and Technology has also adopted 5 villages in the neighbourhood. Realising that teaching a person to fish is better than to feed him, Women empowerment bureau of the Institution conducts several training programmes and vocational courses for women of these villages to financially empower them. It also works with some of the NGOs for the upliftment of the downtrodden by providing them training in a vocation and facilitating income generation. More than 1000 women are trained in mushroom cultivation, sea weed cultivation, ornamental fish culturing, solar lamp making, baking, tailoring, sanitary napkin making, house-keeping, beauty and wellness etc.



Training Programmes to women



Training on Baking

The prestigious “Holiday Training on Baking keeping and had also assured employment for the women in their hotels, if they find them good during training. Three women were placed for employment and that income has helped the families immensely.



Life Skill Training for women's from Perumbakkam

SDG 2 - ZERO HUNGER



Hunger and malnutrition impedes the human progress and pose a major challenge for achieving sustainable development. Research reveals nearly 800 million people live in extreme poverty across the world. To move towards a world where there is no poverty, the world community should jointly take efforts to improve the food system, practice sustainable agriculture, enhance socio-economic status of the people living in poverty, and develop rural economies.

Climate change is the main reason for the decline in food production and the consequent hunger and food security issues faced by the global community. In India food security is a major problem to be addressed in priority over other problems as India failed to achieve the Millennium Development Goal-1 with respect to eradication of poverty and hunger. The problems associated with Climate change, such as declining fertility of land, increasing water scarcity are to be addressed properly in order to increase the agriculture productivity. To end hunger and all forms of malnutrition and to ensure access to food to everyone, by 2030, requires the support of Educational Institutions. We believe higher educational Institutions like us can contribute to eradicate the problem of hunger and malnutrition through innovative research.

2.1 Research Contribution

At Sathyabama, research on effective agricultural practices, organic farming and pest control are undertaken. The Centre for climate change studies is involved in research addressing the issues like maintenance of ecosystems and avoiding degradation of eco-systems, adaptation to climate change, water scarcity, ground water resources and irrigation. Centre for Remote Sensing and Geoinformatics is also involved in research that addresses the change in rainfall pattern, anthropogenic disaster monitoring and so on.

2.2 Training Programmes

The Institution conduct

- Training programmes to students and outsiders in order to develop awareness on these issues and encourage responsible behaviour to combat human caused climate change and promote sustainable way of life.
- Training programmes to farmers on sustainable and resilient agricultural practices.
- Awareness programmes on food wastage and ways to avoid food wastage.

2.3 Outreach Programmes

Sathyabama has always had a social consciousness about the society we are in. The needy and poor are always helped, and many projects to empower them with employment has always been the mission. The students also do a lot of outreach activities in the schools and villages that we have adopted.

The Institution sponsors food to old age homes, homes for destitute women and Children's home in the nearby community as a small step towards eradication of hunger.

Sathyabama's CSR arm has arrangement to donate food to the following orphanages and Homes. Everyday lunch is sent to 120 persons to Little Hearts orphanage in Panaiyur. On the first Saturday of every month 1200 poor people are fed in little mount church and every alternate Tuesdays. 1200 people are fed in the Palavakkam church. About 100 orphan kids in Pudhupakkam get lunch and breakfast from Sathyabama. Other than these, snacks will be sent to some of the students of adopted schools when they stay late for Special classes for their board exams. Christmas is a season of celebration and Sathyabama never fails to extend its arm to the orphanages and Home for the aged, where special food and delicacies are served. Christmas Baskets are sent out in the hope to bring cheer and happiness.

2.4 Food Distribution during Natural Disasters:

Other than giving food to orphanages and Homes, Sathyabama has never failed to rise to any occasion, during natural calamities in Chennai. The huge kitchen in Sathyabama that feeds more than 5000 people every day, three times a day, effortlessly starts cooking for the masses during

any natural calamity. The students also volunteer and their active participation has always been Sathyabama's strength. The food that is cooked and packed by the efficient kitchen gets distributed effortlessly by the students.



fb.com/SathyabamaOfficial

2.5 Women Empowerment and Eradication of Hunger

Empowering women will alleviate poverty and eradicate hunger. The women in the rural areas have been taught many skills that could help them make a living and have a good quality of life.



Training on Tailoring for Women's from Perumbakkam at Sathyabama Institute on 26.08.2019



Training on Seaweed Cultivation for Women's at Thoniravu, Pulicat Lake, Thiruvallur District on 18.06.2019



Training on Mushroom Cultivation for Women's from Kannagi Nagar at Sathyabama Institute on 08.09.2019



Training on Baking for Women's from Perumbakkam village at Sathyabama Institute on 09.08.2019



Training on Beautician for Women's from Perumbakkam village at Sathyabama Institute on 05.02.2019

Sathyabama always believed in the power of women and has a dedicated 'Women empowerment Bureau' that works towards women development.

SDG 3 – GOOD HEALTH AND WELL-BEING



The Institution offers courses like dentistry, biotechnology, biomedical instrumentation, microbiology and nursing, in health related professions.

3.1 Research and Publications

Centre for Drug Discovery and Development focuses on the research to discover novel drugs to fight against life threatening infectious diseases including tuberculosis(TB), Acquired Immune Deficiency syndrome (AIDS), Dengue and non-infectious diseases including cancer, diabetes etc. in order to reduce mortality rates and improve life expectancy. Research in the area of finding drug molecule for Alzheimer’s disease is one of the breakthrough researches going on in the campus. Research papers addressing the issues of health and well-being are published in highly reputed journals.

3.2 Programmes

Awareness Programmes are conducted on various physiological and psychological health issues and life style diseases like hypertension, diabetes, stress, depression. Awareness programmes on Cancer, particularly breast cancer and cervical cancer are conducted for women. Dental camps and medical camps are also organised for the benefit of the people in the neighbouring community.

3.3 General Hospital and Dental Hospital

The Institution has its own General hospital and Dental Hospital that offers medical treatment to the nearby community at a very reasonable rate.

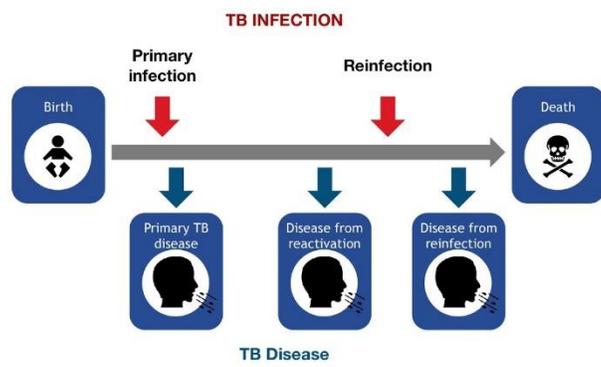
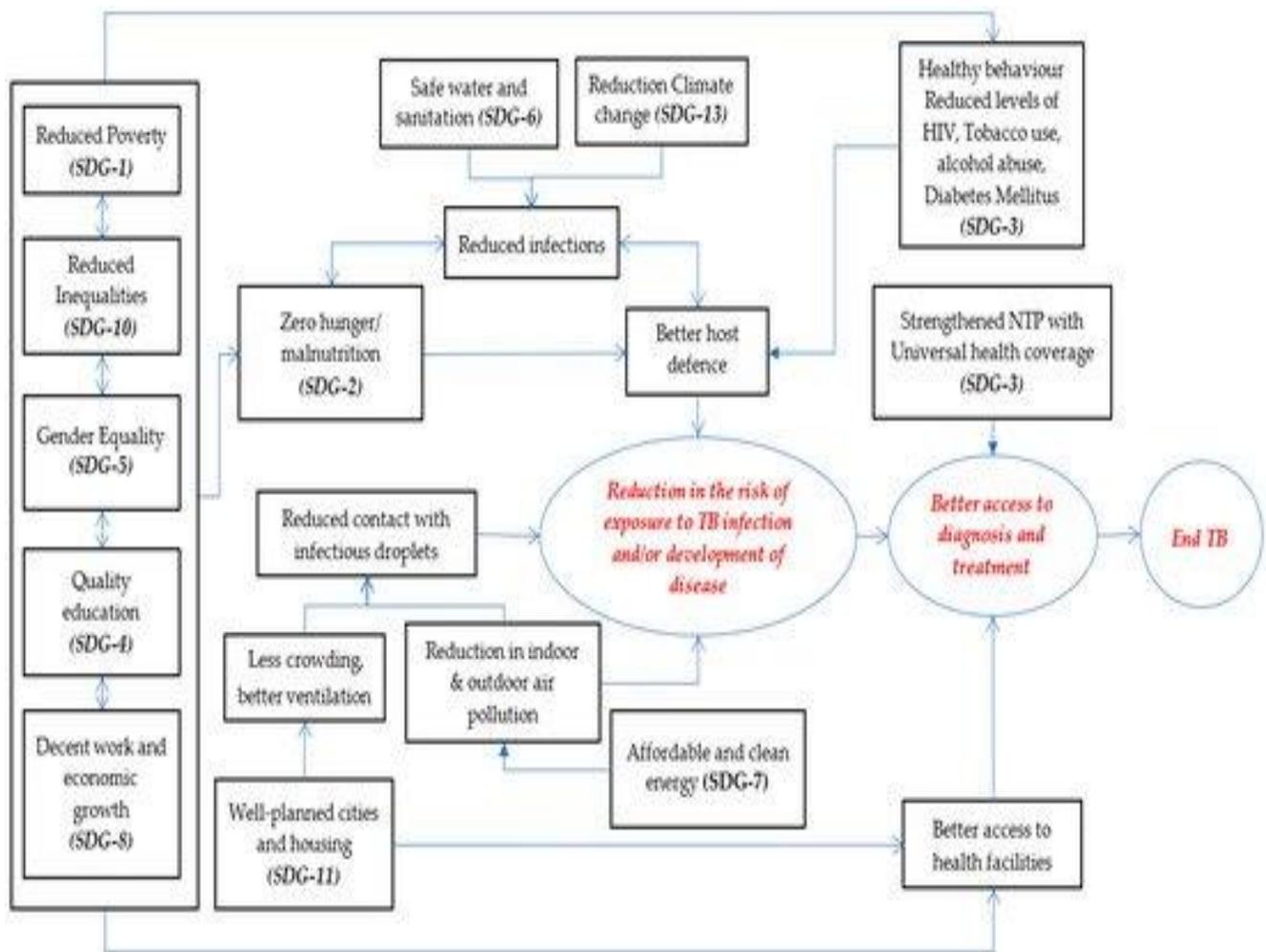
The world has made significant progress, but still faces significant challenges to achieving the 2030 targets for Good Health & Well-Being. Women around the world lack access to sexual and reproductive health care, millions suffer from malnutrition, HIV/AIDS continues to afflict thousands daily, billions of people have no access to life-saving medicine, and we continue to create more waste that will impact the health of all.

Poor health impacts every dimension of human life: lowers access to education and economic opportunities and increases poverty. A cause of poverty, health is also impacted by poverty and Goal 3 is strongly connected to SDGs, such as Goal 1: No Poverty, Goal 2: Zero Hunger, Goal 5: Gender Equality, Goal 6: Clean Water & Sanitation, Goal 13: Climate Action, and Goal 16: Peace, Justice & Strong Institutions.

Sustainable Development Goal 3 seeks to ensure health and well-being for all, at every stage of life. The Goal addresses all major health priorities, including reproductive, maternal and child health; communicable, non-communicable and environmental diseases; universal health coverage; and access for all to safe, effective, quality and affordable medicines and vaccines. It also calls for more research and development, increased health financing, and strengthened capacity of all countries in health risk reduction and management.

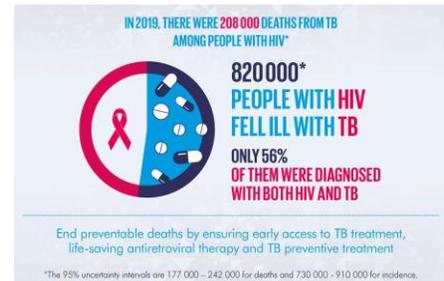
- Studying disease epidemiology, drug discovery by bio prospecting natural resources from by screening to identify potential anti-infective leads.
- Understanding the disease burden and better understanding of the disease pathogenesis
- Monitoring factors that affect human health and well-being, like air quality and traffic
- Supporting health promotion and disease prevention, through the use of wearable monitoring devices
- Enabling remote/rural healthcare and ensuring continuous support until the disease is completely eradicated.

Overall, we can contribute to the prevention of people falling below the poverty line and help target specific support to those in need.

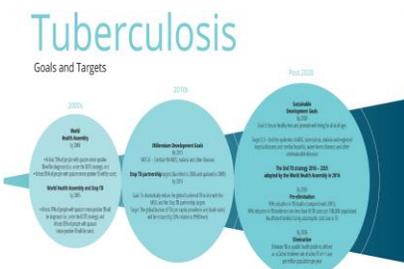


- Tuberculosis (TB) is a communicable disease and its of Global Health Importance
- One of the top 10 causes of death worldwide and the leading cause of death from a single infectious agent.

- TB is caused by the bacillus *Mycobacterium tuberculosis*, which is spread when people who are sick with TB expel bacteria into the air; for example, by coughing.
- The disease typically affects the lungs (pulmonary TB) but can also affect other sites (extra pulmonary TB)
- Drug-resistant TB continues to be a public health threat.
- **TOPNet (Targeting oxidative phosphorylation for the rational development of sterilizing drug combination for drug-resistant tuberculosis Network)** is focused on creating new improved treatments for Tuberculosis (TB). **TOPNet** is a consortium of experts from the Nanyang Technological University Singapore (NTU), National University Singapore (NUS) and the Agency for Science, Technology and Research (A*STAR), Singapore Lead by Professor Gerhard Gruber Singapore PI in in GoI MOE (MHRD) Funded SPARC project with CDDD, Sathyabama.
- ***From crisis to cures: New approaches to TB Drug discovery*** of TOPNet brings together renowned scientists, leaders and advisers of world-wide leading institutions in TB. CDDD, Sathyabama works in close association with Prof Gerhard Gruber, School of Biological Sciences, NTU, Singapore towards developing novel drugs for TB, MDR and XDR TB and also newer affordable diagnostics for identifying the TB disease progression.



Goal 3. Ensure healthy lives and promote well-being for all at all ages



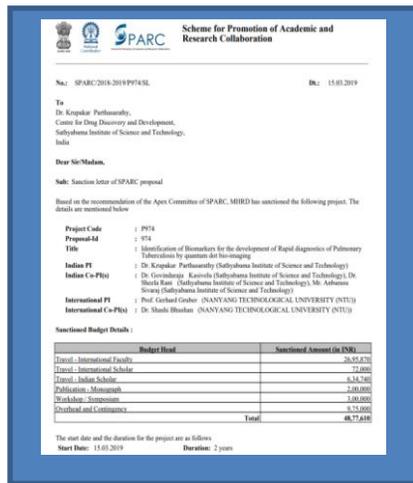
- 3.3 By 2030, end the epidemics of AIDS, tuberculosis and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases

- 3.3.1 Number of new HIV infections per 1,000 uninfected population, by sex, age and key populations
- 3.3.2 Tuberculosis incidence per 100,000 population

- 3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being

The Centre for Drug discovery and Development at Sathyabama Institute of Science and Technology is actively involved in the SDG3.

The vision and mission of the centre focus on exploring the natural resources (microbial and plant) for screening them to identify and isolate potential anti-infective agents for TB and HIV.



The centre has received funding for nearly 4 crores in the past for combating the fight against infectious diseases and management.

The Ministry of Human Research Development- Support partnership for academic research collaboration (MHRD-SPARC) (2019-2021) project - PI – Dr. Krupakar Parthasarathy Scientist D was awarded for Identification of Biomarkers for the development of rapid diagnosis of by quantum dot bio-imaging pulmonary tuberculosis 15.03.2019

amount sanction **Rs. 48,77,610/-** Further to this a MoU with Nanyang Technological University, (NTU) One of the world’s top leading university in Asia Singapore facilitated in 2018 to strengthen the academic and research partnership for TB drug discovery and diagnosis.

The Scheme for Promotion of Academic and Research Collaboration (SPARC) by MoE- GoI (Ministry of Education- Government of India) Previously MHRD (Ministry of Human n Resources Development) aims at **improving the research ecosystem of India’s Higher Educational Institutions and the best institutions in the world** from 28 selected nations to **jointly solve problems of national and/or international relevance**. The scheme proposes to enable productive academic co-operation by supporting the following critical components that can catalyze impact making research, namely:

- ✓ Visits and long-term stay of top international faculty / researchers in Indian institutions to pursue teaching and research from Sathyabama- India and NTU-Singapore.
- ✓ Visits by Sathyabama students for training and experimentation in premier laboratories in NTU Singapore.
- ✓ Joint development of niche courses, world-class books and monographs, translatable patents, demonstrable technologies or action research outcomes and products with NTU Singapore.
- ✓ Consolidation of Bilateral co-operation through academic and research partnerships related to tuberculosis diagnostics and therapeutics development and also conducting Indo-Singapore Workshops in India.
- ✓ Publication, Dissemination and Visibility through a high profile annual international Conference in India.
- ✓ Thrust Areas: Convergence, Sub Domain: Affordable Health Care
Sanctioned Amount : Rs. 48,77,610/- For 2 Years (2019-2021)

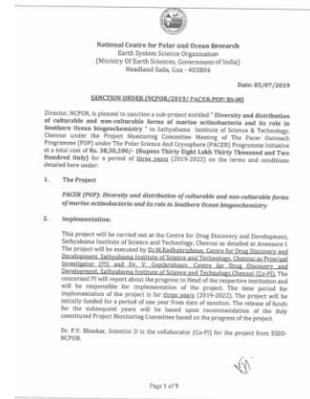
A MoU signed with Global Hospitals, Chennai, Tamil Nadu, India for biomedical research and the MoU with Life Cell Technologies, Chennai for stem cell research was inked in 2019 to further jointly collaborate on communicable and non-communicable diseases research.

Dr. M. Radhakrishnan, Scientist E and Dr.Jerrine Joseph, Scientist D from the same centre has got selected from Indian side to participate in the UK – INDIA Newton Bhaba joint Researcher link work shop on Challenges in Tuberculosis during 16th – 19th December 2019 at ISER Pune. This workshop was jointly conducted in collaboration with Public Health where the natural product drug discovery for TB was highlighted the burden and challenges involved were discussed.

Dr. M. Manikandan Scientist C from the centre was awarded Indian Council of Medical Research - Department of Health Research fellowship to be trained in virology at Prof .Barry Rouse lab in University of Tennessee USA for the period of one year since December 2019.

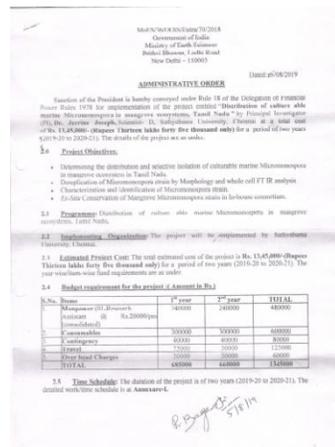
- Pathogenesis of Herpes Simplex virus talk delivered by Dr. Barry Rouse University of Tennessee , USA on 11.12.2019“

Ministry of Earth Sciences –National Centre for polar and Ocean Research Project awarded to PI: Dr. M. Radhakrishnan for understanding and deciphering the Diversity and distribution of cultural and non-cultural forms of marine actinobacteria and its role in Southern Ocean biogeochemistry Rs. 38,32,000/- 05.07.2019(2019-2021) indirectly impacts SDG3 by having an impact on climate change



Ministry of Earth Sciences Project: awarded to PI: Dr. Jerrine Joseph Distribution of culturable marine Micromonospora in Mangrove ecosystems, Tamil Nadu Rs. 13, 45,000/-05.08.2019 (2019-2021) to study the diversity which indirectly impacts SDG3 by having an impact on climate change

Tamil Nadu State Forest Dept & Biozone Pvt Ltd together with industry and academic partnership received this grant to address Bacterial disease management by microbial eco-friendly Approach For Forestry: With Special Reference To Bamboo Rs. 690000 (2019-2021) indirectly impacts SDG3 by having an impact on climate change



Herbal Denture Cleanser Formulation And A Method Of Preparing The Same -Indian patent filed on 8/8/2019 and Non-alcoholic hand sanitizer and a method of preparing the same Indian patent filed on 2 12/12/2019 both impacts SDG3 for health and hygiene and as health care product development for the common good

As part of knowledge dissemination initiatives to control communicable and non-communicable diseases several guest lectures, invited talks, conferences/ workshops and seminars have

been organized by the centre in 2019 like the following:

- National Symposium on Bio-prospecting of marine resources for biotechnological application: Opportunities and Challenges (NSBMB_OC-2019) Date: 24 th& 25 th July, 2019 sponsored by the Department of Science and Technology, New Delhi

- Dr. Jayandran IIT Kanpur on 18.06.2019 delivered a talk on Gene Therapy from Bench to bedside to students
- “Opportunities, Challenges and Future Directions in Life Science Research” brainstorming session



by Dr.Sadhana Ravishankar and Dr. Dr. Ravishankar Palanivelu From University of Arizona USA 27.6.2019 to address the current cutting edge trends in scientific research and food borne pathogens which directly impacts SDG3

- Awareness programs on TB/HIV for student community, researchers and staff is usually conducted to spread awareness.
- Pathogenesis of Herpes Simplex virus talk delivered by Dr. Barry Rouse University of Tennessee , USA on 11.12.2019
- NABL accreditation scope and progress for research scholars / scientist and industry 12.4.2019

Biosafety Standard operating protocols being maintained in TB/virology labs to have a process in place

- Quality control activities in testing laboratories by Dr. Gurumurthy Scientific Food testing services pvt Ltd Chennai.12.4.2019 for spreading the awareness on food adulteration which greatly impacts SDG3
- molecular plant-microbe Interaction - a triangle investigation” delivered by 30.1.2019 by Dr.KuberanThangaraj from Tea Institute, College of Horticulture, Nanjing Agricultural University , China



THE UNIVERSITY OF TENNESSEE 
 COLLEGE OF VETERINARY MEDICINE
 Department of Pathobiology
 Date: 03/01/2020

Dr. Manikandan Mathayan
 Scientist-C
 Center for Drug Discovery and Development
 Col. Dr. Jigajig Research Park
 Sathyabama Institute of Science and Technology,
 Chennai, India, 600339.

Dear Manikandan Mathayan,

Congratulations for your award from the "ICMR-DHR long term (one year) International Fellowship for young bio-medical scientists". I am happy to welcome you to my laboratory here at the University of Tennessee to learn advanced techniques and concepts on herpes simplex virus from 03/01/2020 to 31/12/2020.

Yours Sincerely


 Barry S. Rouse, DVM, PhD, DSC
 Lindsay Young Distinguished Professor
 UTIA Institute Professor
 College of Veterinary Medicine
 University of Tennessee
 Knoxville, TN 37950-0845
 865-974-6206, fax -7817
 bsr@utk.edu
https://vmed.tennessee.edu/home/pages/faculty_staff_details.aspx?staffid=20
<https://scholar.google.com/citations?user=0t-wf8AAAAAJ&hl=en>

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3.4 CDDD PUBLICATION in 2019 for SDG3- No's (10)

1.	Applications of feather keratin hydrolyzate in divergent field	Santhiyaa RV, Wilson Aruni A, Suresh G, Prasanna Balaji N, Barathi S, Pugazhvendan SR, Rajasekar T, Karthikeyan DR and Kumaran S.	Biosc.Biotech. Res.Comm	12 (4) 00-00	2019	December
2.	Isolation, characterization of lactic acid bacteria from cow and buffalo milk and evaluation for antibacterial and antimycobacterial activity <i>in vitro</i> .	Revathy K., Radhakrishnan M* and Sivaraaj A	Asian Jr. of Microbiol. Biotech. Env. Sc.	21(4) : 2019 : 1041-1046	2019	DEC
3.	Bioleaching of heavy metals from printed circuit board (PCB) by <i>Streptomyces albidofavus</i> TN10 isolated from insect nest	Dhanalashmi Kaliyaraj, Menaka Rajendran, Vignesh Angamuthu, Annam Renita Antony, Manigundan Kaari, Shanmugasundaram Thangavel, Gopikrishnan Venugopal, Jerrine Joseph, and Radhakrishnan Manikkam	Bio resources and Bioprocessing	2019:06:47	2019	Nov
4.	Bioelectricity generation from industrial effluent through actinobacterial fuel cells	M. Sangeetha, B. Surya,, A. Sivarajan , , M. Radhakrishnan,, J. Jerrine and R. Balagurunathan	Poll Res.	38 (Suppl. Issue): S77-S83 2019	2019	Nov
5.	Isolation, characterization and identification of antibiofouling metabolite from mangrove derived <i>Streptomyces sampsonii</i> PM33	Venugopal Gopikrishnan, Manikkam Radhakrishnan, Thangavel Shanmugasundaram, Meganathan P. Ramakodi and Ramasamy Balagurunathan	Nature Scientific Reports	9 (2019); 12975	2019	Sep

6.	Screening, production and characterization of biologically active secondary metabolite(s) from marine <i>Streptomyces</i> sp. PA9 for antimicrobial, antioxidant and mosquito larvicidal activity.	Sivarajan, A., T. Shanmugasundaram, M. Sangeetha, M. Radhakrishnan and R. Balagurunathan.	Indian Journal of Geo Marine Sciences.	48(8); 1319-1326.	2019	
7.	Influence of magnesite mine soil for enhancement the efficiency of bioactive compound production from Actinobacteria.	M. Sangeetha, A. Sivarajan, M. Radhakrishnan and R. Balagurunathan.	Drug Invention Today.	12(8); 1614-1619.	2019	
8.	Bioprospecting of actinobacteria from Andaman marine ecosystem: Isolation, antagonistic potential and taxonomy of potential strain	Manisha Mohandas, Mithali Jain, G. Vijayalakshmi, V. Gopikrishnan, M. Masilamani selvam and M. Radhakrishnan.	Indian Journal of Geo Marine Sciences	48(8); 1312-1318	2019	
9.	Bioactive potential of actinobacteria isolated from the gut of marine fishes	A. Vignesh, S. Ayswarya, V. Gopikrishnan, M. Radhakrishnan	Indian Journal of Geo Marine Sciences	48 (08); 1280-1285		
10.	Bioactive potential of selected actinobacterial strains from Andaman marine ecosystems effective against <i>Mycobacterium tuberculosis</i> and other clinical pathogens	Manigundan. K, Revathy Sundar, Sivarajan, S. Anbarasu, Jerrine Joseph, and R. Balagurunathan	Indian Journal of Geo Marine Sciences.	48(8); 1307-1311	2019	Aug

SDG 4 – QUALITY EDUCATION



The mission of Sathyabama Institute of Science and Technology is to provide quality education to the students and develop qualified manpower for the Nation. The Institution offers courses in Engineering, Science, Technology, Arts, Management, Dental, Nursing and Law and develops professionals.

The Institution encourages quality research and publications on these subject areas. Faculty members and the research students' publish articles on thrust areas of the Engineering, Science, Technology and Management.

Sathyabama takes efforts for inclusive education that provides access to education to everyone. It offers education opportunity for all that include diverse ethnic, religious, socio-economic, cultural group without discrimination. Boys and girls from all strata of the society have access to the opportunities. Students across India hailing from different states, speaking different languages study at Sathyabama. Students from neighbouring countries like Nepal, Srilanka and Myanmar study in the Institution. Students from low income Countries like Nigeria, Congo, and Cameroon visit our Institution for pursuing their research.

The Institution offers opportunity for free education to economically backward students. This promotes access to quality education to everyone as financial status is not a constraint. The desiring students from rural, economically backward section and first generation graduates are given 100% scholarship with free accommodation and food.

4.1 Adoption of Schools

An educated society will always be a developed society. Schooling at primary and secondary level is very important and through good education poverty can be eradicated from the community. The Institution besides taking care of the tertiary or University level higher education of the needy and the downtrodden also takes care of primary and secondary level school education. It has adopted 21 Schools in the nearby community and provide all financial and infrastructure support to develop these Schools. The students are given every possible support and mentored and developed by the Institution. **“Lab on Wheels”** is one initiative of the Institution where Sathyabama’s mobile Laboratory visits the schools regularly.

Sathyabama also takes care of the salary of the Teachers of these adopted Schools.



Signing MOU's with Adopted Schools



The students of Sathyabama also visit the schools, teach the students there, give them motivation and inspire them. When the school students visit the university they are given hands on training in computers and are really made to understand the importance of good education. Other than school and college students, Sathyabama aims at educating the adults in the rural areas and in the areas below poverty line with vocational courses to help them have a regular income.



Training students and Adults from Adopted schools & villages

4.2 Adopted Schools and their requirements satisfied for the period 2019

Sl. No.	Name of the School	Requirements satisfied
1	Panchayat Union Middle School, Perumattanallur	Minor Repair works, White wash
2	Panchayat Union Primary School, Venkatapuram	projector and Screen for Smart Class, Audio System
3	Panchayat Union Middle School, Appur	Laptop, Printer
4	Panchayat Union Middle School , Thenmelpakkam. Singaperumalkoil 603204	Public address System
5	Govt.High School, Nellikuppam Road, Kumizhi	Desktop
6	Panchayat Union Primary School , Mannivakkam	2 Desktop with Furniture
7	Panchayat Union Primary School, Asthinapuram	Plastic Sheet Roofing
8	Panchayat Union Middle School, Nallambakkam	printer, Laptop
9	Government High School, Asthinapuram	LED Display TV
10	Thanthai Periyar Govt. Higher Secondary School, Puzhuhdivakkam	LED Display TV
11	Panchayat Union Primary School, Vandalur 600048	Mike set with Amplifier, Borewell
12	Panchayat Union Primary School, Kumizhi	Computer, Speaker, Amplifier with Hand mike set, Printer
13	Panchayat Union Primary School , Venbakam	Sports Material, Prayer hall Flooring

14	Panchayat Union Middle School , Aalapaakam	Printer,Library Almirah
15	Govt.(ADW) Primary School, Kilambakkam	3 teachers and 1 sleeper cum Scavenger
16	Govt. High School - Perumbakkam	Shed
17	Govt. High School - Lakshmipuram	Rs 7000/class room painted by our viscom students for 5 class rooms
18	Govt. High School - Kudimiandithopu	CCTV Camera
19	Govt. Higher Secondary School - Chemmenchery	Repair works
20	Govt. Higher Secondary School - Pallikaranai.	Computer with scanner cum printer
21	Govt. Primary school, VANJIVAKKAM	Uniform for 48 students
		Salary for 2 Teachers

4.3 Skill Development Centre

Sathyabama Institute of Science and Technology has a dedicated Skill development Centre that conducts various value added skill development courses in association with National Skill Training Institute (NSTI), Ministry of Skill Development & Entrepreneurship (MSDE) with the objective of promoting entrepreneurship and improving the employability of the students.

The Skill development Centre organises and conducts various skill development and vocational education programmes to youths, who are school drop outs and rural women. These training programmes are conducted with the aim of teaching a vocation or skill to the under privileged people, so that they earn their livelihood. Women are trained in vocations like tailoring, baking, beauty and wellness, incense stick making, candle making, mushroom cultivation, sea weed cultivation and solar lamp making. Men are trained in electrical work, repairs and maintenance of home appliances, laptop servicing and plumbing. These people are also given technical and financial support to start their own business and earn as independent entrepreneurs.

4.4 Centre for Professional and Career Advancement

Sathyabama Institute of Science and Technology has established a Centre for Professional and Career Advancement through which Online Certificate and Post Graduate Diploma courses are conducted. This centre works with the objective of providing a life-long learning platform for all

aspiring learners in order to reskill or up skill their knowledge and become an industry-ready workforce through a systematic approach. This is an initiative to utilize the faculty expertise and the IT infrastructure available in the Institution to provide benefit to the learners across the globe by providing quality online education. This Centre is highly beneficial to students who are not able to continue with the formal college/university education as it provides Skill Based Vocational Courses and Technology Related Courses that expands the opportunities for employment.

4.5 Guidance for Higher Studies

Sathyabama provides guidance to students for higher studies at top-notch academically and culturally affluent Universities. To prepare the students for higher studies, GRE, GMAT, TOEFL, IELTS, GATE, CAT training is offered by renowned Training Institutions. A separate and well equipped library is set up to provide study material for the students who are preparing for competitive examinations. Sathyabama's Centre for higher studies counsels and supports its students for their enrollment at Universities across the world.

4.6 Jeppiaar IAS Academy

Jeppiaar IAS Academy is one of the initiatives taken by the Institution with the objective to offer free coaching to students who aspire to become civil servants.

SDG 5 – GENDER EQUALITY



Sathyabama is an Institution that works consistently towards achieving gender equality which is one of the fundamental rights. It believes that achieving gender equality is essential for developing a sustainable community. The enrolment figures for various programmes of the Institution ensure the equal participation of girls in the education. Sathyabama, as an employer, practice positive discrimination towards employment of women. Women occupy most of the key positions in the Institution and more than 60 % of the staff members are women. The Chancellor and the Vice Chancellor of the Institution are women.

In any committee or club or any forum, the equal representation of girls and women is a strictly followed norm at the Institution. The concept and the ideology of gender equality is deeply rooted in the core value of the Institution. Men and women have equal access to opportunities at The Institution and equally participate in policy making and administration.

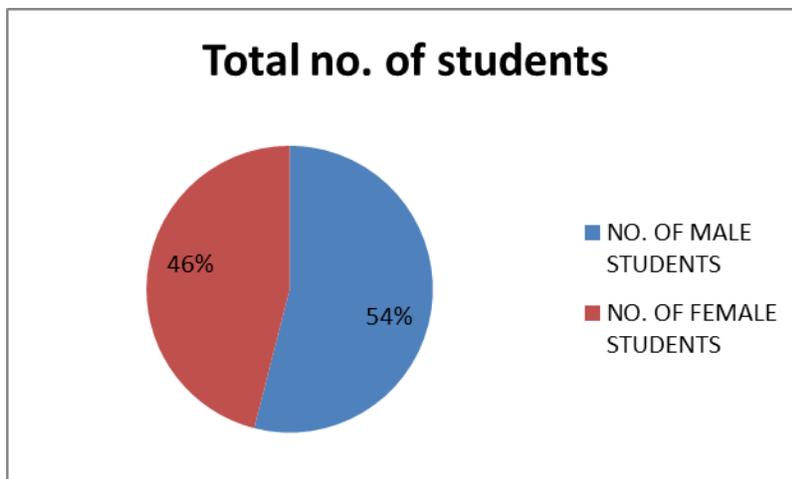
Sathyabama Institute of Science and Technology has always been an unbiased institution, merit is based on performance only. With 80 percent of the workforce being women, Sathyabama strives to set out the bias against women in developing countries like India, by tilting the scales a bit towards women. The existence to the “Women empowerment bureau’ the “ Anti-Discrimination Cell”, ‘Human rights cell’, ‘grievance cell’ just goes to prove that the University has always been conscious in seeing that there is no discrimination based on gender.

All outreach activities, and out NSS and NCC cadets are a right mix of girls and boys. All activities are planned to include all the genders. It has been our strength that we not only preach, but also practice not only Gender equality, but equality to all of mankind, and that reflects in all the activities the University takes up for social causes.



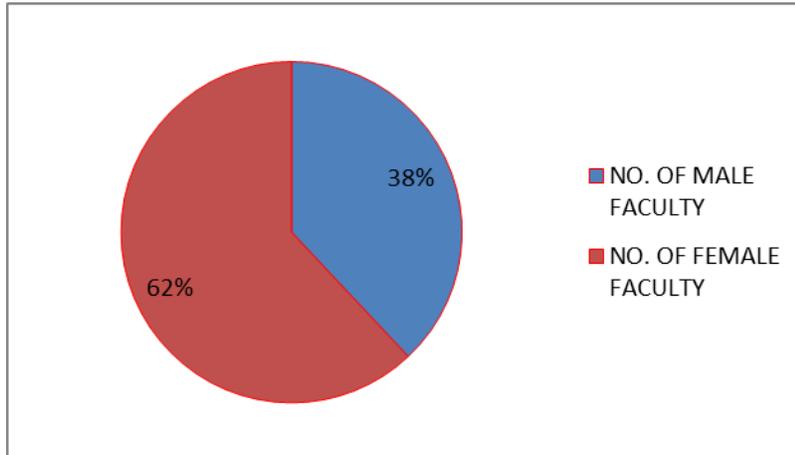
GENDER RATIO IN OUR UNIVERSITY (Students)

PROGRAMME	NO. OF MALE STUDENTS	NO. OF FEMALE STUDENTS
UG (3 Years)	302	418
UG (4 Years)	4967	4602
UG (5 Years)	304	549
PG (2 years)	406	464
PG (3 years)	2	5
Total no. of students	6403	5616



GENDER RATIO IN OUR UNIVERSITY (Faculty)

Total faculty	NO. OF MALE FACULTY	NO. OF FEMALE FACULTY
1060	403	657



5.1 Aims and Goals

The Aim of having the 'women empowerment bureau' and many other cells is just to be more mindful about having a balance way of dealing with Students. Staff and the society that we serve. Sathyabama rightly believes that a society that has empowered women, and where equality exists, growth becomes inevitable.



The students participate in Gender equality seminars, webinar and many other programs, but are also made to have hands on experience while they visit villages and the schools that we adopt.

Anbu Foundation the CSR arm of the University was started with the aim of giving free education for girls from poor families. It soon turned out that we had

to also consider the boys as in some cases there is no equality when there is poverty. It is because of that, the ratio of girls to boys has been kept higher consciously.

The need for financial independence of women, especially in the economically weaker background is also emphasised and women are trained to become financially independent.

Other major factor is the health. It has been found that in developing countries like India, the people who live below poverty line, especially the women tend to ignore, health and hygiene. Medical camps are held regularly in the college campus as well as in the villages and the schools that we adopted.



5.2 Seminars and Workshops

It has been a conscious endeavor and every occasion is used to bring awareness of gender equity. The women's day is an occasion used to send messages of gender equality.

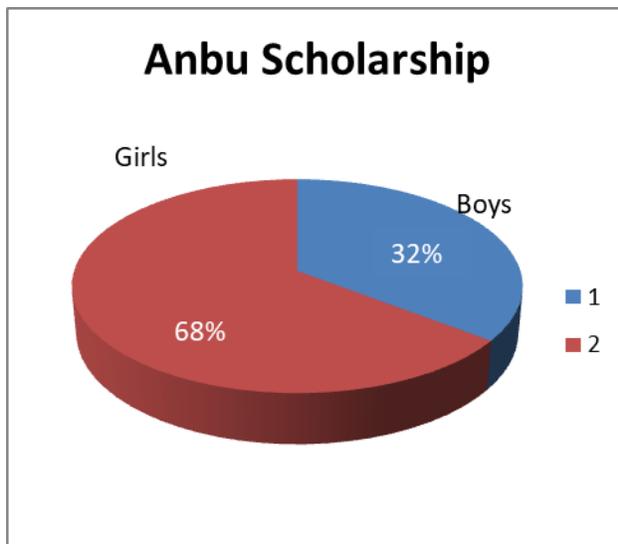
On women's day and exclusive mime was organized by the 'Women empowerment Bureau' to showcase the sexual

harassment women with disabilities face, and how as a society we could stand up for them, and how even they can overcome and gain strength. As Sathyabama always have many Hearing impaired students, it was not only an eye opener for them, even the other students realized the difficulties faced by these women. The whole event was put together by a theatre Group 'ACT' and the plays that were enacted were written by an activist, Mr. Gnani who worked for women's rights. The late Mr. Gani and his wife Mrs. Padma Gani have been empowering women by using street plays, dramas and mime's and we had the privilege of having one his plays enacted in our university.



5.3 Gender Ratio among Scholarship Students

The following charts will explain the ratio of girls to boys in the scholarship scheme.



Academic Year	Boys	Girls
2019 - 2020	231	342
2018 -2019	208	361
2017 - 2018	182	305
Active Students	833	1336

SDG6: CLEAN WATER AND SANITATION:



6.1 Ensure availability and sustainable management of water and sanitation for all

Sathyabama Institute of Science and Technology has taken substantial steps in meeting SDG 6(Clean Water and Sanitation) in terms of noteworthy research publications, innovations,



capacity building programmes for students, faculties and through dissemination activities to the rural communities

As per SDG 6.1 and 6.2, By 2030, achieve universal and equitable access to safe and affordable drinking water and access to adequate and equitable sanitation and hygiene for all, initiatives, innovative projects and awareness

programmes were conducted especially for adopted villages under the scheme of **Unnat Bharat Abhiyan, Government of India.**

Series of Training programmes are conducted for young and dynamic students volunteers of NCC,NSS, Science club and Women Empowerment Cell in order to educate the rural school students and economically privileged communities to know the importance of sanitation - hygiene behavior and water use efficiency



Sathyabama Institute of Science and Technology NCC cadets from Air force and Navy were recognized for their service under category “WOMEN IN UNIFORM” in the WOMEN’S ICON 2019 conducted by Master Mind Foundation. These cadets received awards from the honorable Governor of



Tamil Nadu, Shri Banwarilal Purohit on 2nd March, 2019. Our cadets had the opportunity to

meet and interact with Shri V. Kalyanam, the Personal secretary of the Father of our nation, Mahatma Gandhiji (1942-1948) and the first woman Psychiatrist of India, Dr. Saradha Menon.



6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally

6.2 Prominent initiative taken by the Institution –Establishment of Sewage Treatment Plant

In the state of industry collaboration laboratory facility, Sewage Treatment plant (STP) is established in the year 2019 in association with in-house Department of civil Engineering, Department of Chemical Engineering, Centre for Waste Management and Eco care Engineering Systems Pvt. Ltd to treat about 15 lakh liters of raw sewage water in a day which adopts Sequential Batch Reactor (SBR) process.



Specifications	Details
Freshwater requirement for campus per day	9 lakhs litres
Wastewater generated	7.5 lakhs litres
Source of Water for Treatment	Mess kitchen and hostel toilet water
Capacity of Water treatment facility per day	7 lakhs litres
Usage of treated water	Landscaping and gardening
Outcome	Reducing the freshwater consumption for secondary purposes

Figure Development of Sewage Treatment Plant for Sathyabama University Campus in Association with Ecocare Engineering Systems and Centre for Waste Management-Innovation Industry Supported Lab

The STP is equipped with Sensors for Automated control over the SBR design suggested and updated by the Industrial Experts. Further the STP is helpful in performing the case study experiments and research oriented activities. Periodical monitoring is also taking place in the regular interval. The treated water and sludge generated during the treatment process are well utilized for research purpose for characterizing and re usual of water and sludge.





The Tamil club has conducted a Tamil stage play named “KAVERI” – Awareness about water utilization by Mr.Raja,Alumnus of our institution on 5th March, 2019. The play was informative and students were enlightened about the importance of utilizing water to the needed extent.

6.3 Research Publications which supports SDG 6 to improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
Raja, Umer Khalifa Saleem; Ebenezer, Vinitha; Kumar, Amit; Sanjeevi, Prakash; Murugesan, Murali, Mass mortality of fish and water quality assessment in the tropical Adyar estuary, South India Environmental Monitoring and Assessment

Rawat, K.S., Jeyakumar, L., Singh, S.K., Tripathi, V.K. Appraisal of groundwater with special reference to nitrate using statistical index approach, Groundwater for Sustainable Development
Vijayalakshmi, P., Eshanthini, P., Vanitha, S., Sharath Kumar, R., Vigneshwaran, B.Reduction of strength of domestic wastewater using natural fibrous materials, Rasayan Journal of Chemistry

Mahato, B.N., Krithiga, T.Efficient removal of arsenic and chromium from waste water by solvent free synthesized $\text{Fe}_2\text{O}_3/\text{AISBA-15}$ adsorbent, Materials Today: Proceedings

Vanitha, S., Rajan, N.K. (2019) Removal of E.Coli from groundwater and surface water by using nylon membrane filtration technique, Rasayan Journal of Chemistry

S Sathish, K Thamaraiselvan, PA Theenesh, C Venkatesh, TRB Chander, Effect of chrome tanning effluent on cohesive soils

By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

Students were encouraged to undergo the internship trainings in the public water supply agencies to understand the water supply processes which is based on the needs and priorities which was evident

Masarapu Hemanth Kumar (Final year Civil Engineering student) , Water Resources Department, 17/05/2019 to 06/06/2019 which is supporting SDG 6.4

6.5 Research publications

Subramanian, T. Siva; Abraham, Marykutty ,Computation of aquifer parameters using geoelectrical techniques for the North Chennai coastal aquifer, Indian Journal of Geo-Marine Sciences

Subramanian, T.S., Abraham, M.Assessment of natural groundwater recharge: A case study of North Chennai Aquifer,Environmental Geosciences

Abraham, M., Mohan, S Effectiveness of check dam and percolation pond with percolation wells for artificial groundwater recharge using groundwater models, Water Science and Technology: Water Supply

Nandhakumar, S., Arsheya, S., Kirthika Sri, V.K. (2019)Estimation of rainfall runoff using SCS-CN and GIS approach in puzhal watershed, International Journal of Civil Engineering and Technology

Krupakar, Hitesh Packialakshmi,Investigation of Saline water Intrusion in near coastal zone of Chennai Metropolitan Area

Dr.Nandhakumar- Estimation of Rainfall Runoff Using SCS-CN and GIS in Red Hills Watershed

Dr.Nandhakumar- Design of Efficient groundwater recharge system for KodambakkamChennai

Ms.Eshanthini-Ground water flow modeling using Modflow in Poondi subwatershed

Ms. Shrimathy and Packialakshmi, Assessing the status of groundwater aquifer in and around Marshy Land Area, Chennai, won Best paper Award in the National conference conducted by Centre for Remote Sensing and Geo Informaticsm Sathyabama Institute of Science and Technology, 22-23, Oct 2019

6.4 Innovation which are strongly supporting SDG 6

Dr. Meera Gandhi-Computer Science Engineering-Automated robot for precision farming with automated Rubber tapping machine, Total Seed Grant/Fund Amount Disbursed to above Idea/Prototype/Innovations Development by Centre (In Rupees)Rs.700000/-Patent applied, Appl. No. 2019 4101 4820

Dr.S.Vigneshwari, Computer Science Engineering Agriculture Drone with Pesticide Sprayer, Patent applied -3169 63- 001- (18-0 4-201 9) Total Seed Grant/Fund Amount Disbursed to above Idea/Prototype/Innovations Development by Centre Rs.400000/-

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

Research publications which are strongly supporting SDG 6.6.1 Change in the extent of water-related ecosystems over time are:

Anusha, N., Bharathi, B., Change detection and flood water mapping using sentinel-1A synthetic aperture radar images, Journal of Computational and Theoretical Nanoscience

Thaj Mary Delsy, T., Jamuna Rani, D., Marshiana, D. Health parameter analyses of living organism in underwater environment, Indian Journal of Public Health Research and Development

K Nagamani, Y Suresh, [Evaluation of coastal aquaculture ponds using remote sensing and GIS](#)
NISCAIR-CSIR, India

Research publications which are strongly supporting SDG 6.a By 2030, expand international cooperation and capacity-building support to developing countries in water and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies are:

Rameshkumar, C.; Senthilkumar, G.; Subalakshmi, R.; Gogoi, Risam, Generation and characterization of nanobubbles by ionization method for wastewater treatment Desalination and Water Treatment

Manisha, M.; Mithali, J.; Vijayalakshmi, G.; Gopikrishnan, V.; Masilamaniselvam, M.; Radhakrishnan, M. Bioprospecting of actinobacteria from the Andaman marine ecosystem: Isolation, antagonistic potential, and taxonomy of potential strain, Indian Journal of Geo-Marine Sciences

Mathew, R.A., Lavanya, V., Rasiga, S., Abraham, M. (2019) Bioremediation of marine oil spill using beeswax , Indian Journal of Geo-Marine Sciences

J Aravind Kumar, D Joshua Amarnath, S Sathish, S Anuradha Jabasingh, A Saravanan, RV Hemavathy, K Vijai Anand, PR Yaashikaa (2019) Enhanced PAHs removal using pyrolysis-assisted potassium hydroxide induced palm shell activated carbon: batch and column investigation, Journal of Molecular Liquids 279, 77-87

A Suresh, S Sathish, G Narendrakumar, Electrocoagulation of azo dye containing synthetic wastewater using monopolar iron electrodes and the characterization of the sludgem Water Practice & Technology 14 (3), 587-597

Ms.Shrimathy (Final Year Student)- Investigation of water quality and treatment using aquatic plants in and around Ranipet, Vellore

Ms.Shrimathy and Packialakshmi Investigation of water quality and Treatment of wastewater using aquatic plants, 30th Aug 2019,organized by SRM Institute of science and technology, Ramapuram campus, Chennai

Ms. Kavisri- Removal of Fluoride by using Green Synthesis of Zinc Oxide Nano Particles

Ms.Priyadharsini-Experimental Investigation of Tannery Wastewater by Electrochemical Method

6.5 Patent Filed during the Year 2019 related to SDG 6

Ms.Vanitha- Climatization Process in Residential Building Using Geo Exchange System – FILED (25-04-2019)

Faculty certification courses related to SDG 6.a

Ms.Vanitha, Faculty from Department of Civil Engineering has completed following NPTEL COURSES - Electronic Waste Management – Issues and Challenges (Jan-Feb 2019) and Integrated Waste Management for a Smart City (July – Oct 2019)

Dr.S.Packialakshmi, Faculty from Department of Civil Engineering- Wastewater Treatment and Reclamation Obtained 73%(July-Oct 2019) and attended following capacity building activities 6th Asia-Pacific Coastal Aquifer Management Meeting –International Workshop, Department of Geology, Anna University, 11 December 2019

Workshop on Trending Environmental Software, Hindustan Institute of Science and Technology Chennai, 5-6, December, 2019

Training Programme on Recycling of Processed Water in Industries, Industrial Waste Management Association, Chennai, 8th February, 2019

Ms.Eshanthini, Faculty from Department of Civil Engineering -Workshop on Groundwater flow modeling using Visual Modflow VIT vellore 18, 19 October 2019

B.Priyadharshini, Faculty from Department of Civil Engineering- Publications related to SDG 6.a

B.Priyadharshini, Aravind, Depak Kumar, Study on Water Quality in Pernambut Vellore Using WQI, 21.03.2019, , Adhi Engineering College, National Conference

B.Priyadharshini, Abhishek , Gowtham , Spatial and Temporal Variation of water quality St peter’s College of Engineering and Technology, 19.03.2019 & 20.03.2019, National Conference



ECO club has conducted " ECOMANIA" on 19th February, 2019. Students actively participated in all the environmental awareness related activities.

The ECO CLUB has conducted a Workshop titled "Composting" on 16th July,2019. Students participated in the workshop with enthusiasm and undergone hands-on experience about the best methods of Bio-Composting which is strongly supporting SDG 6.a



SathyabamaOfficial



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6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government coordinated spending plan

National Conference on Recent Advances in Anthropogenic Disaster Monitoring in Association with Ministry of Earth Sciences and International Journal of Advanced Multidisciplinary Scientific Research (IJAMSR) 22-23 October, 2019

National seminar on emerging trends in satellite technology and its applications in Association with Indian Space Research Organization, Govt. of India (ISRO) Dates: 22nd to 23rd March 2019

Dr. Anoop Kumar Mishra, Scientist, Centre for Remote Sensing and Geoinformatics, Developing near Real Time Flash Flood Risk Monitoring Scheme over India, Funding Agency-MoES

6.b Support and strengthen the participation of local communities in improving water and sanitation management



Beach Cleanup activities at Kanyakumari District by Student cum Social activist Mr.Melbin Robin- Final Year Civil Engineering on 26.12.2019

SDG 07 AFFORDABLE CLEAN ENERGY



7.1. Global Scenario in Clean Energy

Energy plays a vital role in the Sustainable Development Goals (SDG) from increasing access to electricity, to improving clean cooking fuels, from reducing wasteful energy subsidies to curbing deadly air pollution. One of these goals which is projected under SDG 7 aims to ensure access to affordable, reliable, sustainable and modern energy for all by the end of the next decade.

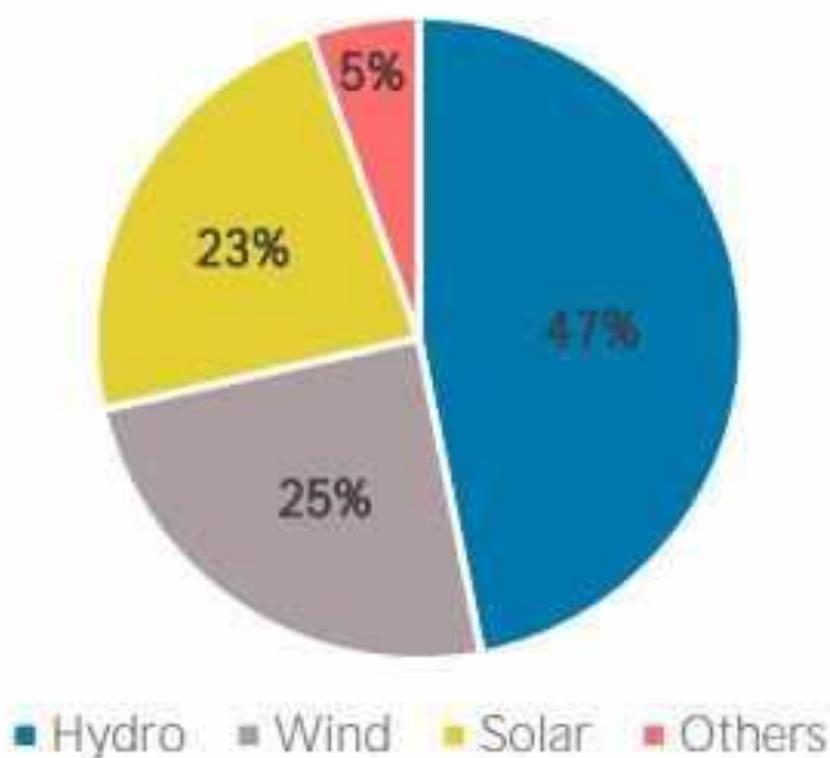
The important disadvantage present in the energy production from fossil fuels is the emission of about 60% of global greenhouse gas. While some 17% of energy consumption is now met with renewables, the Intergovernmental Panel on Climate Change warns that this needs to reach around 85% by 2050 to avoid the worst impacts of climate change. Over 50% of our global population lives in cities. They are also responsible for around 70% of global energy related emissions. They are on the frontline of both climate impacts and the transition to a sustainable future for all.

Greater investment and policy support for distributed renewable solutions including solar lanterns, household rooftop solar panels and mini-grids powered by wind, water or sun is the fastest, cleanest, and most affordable way of achieving energy access.

The renewable energy sources (RES) such as solar, wind and hydel have significant potential to contribute to the economic, social and environmental energy sustainability of the globe. They

improve access to energy for most of the population, they also reduce emissions of local and global pollutants and they may create local socioeconomic development opportunities.

According to the International Renewable Energy Agency (IRENA) report, Solar and wind energy continued to dominate renewable capacity expansion, jointly accounting for 90 per cent of all net renewable additions in 2019. In 2019 the global renewable generation capacity amounted to 2,537 GW where hydropower accounted for the largest share of the global total, with a capacity of 1,119GW.



Wind and solar energy capacities were at 623 GW and 586 GW, respectively. Whereas, other renewables included 124 GW of bioenergy, 14 GW of geothermal plus, and 500 MW of marine energy. Asia accounted for 54 per cent of new capacity in 2019, increasing its renewable capacity by 95.5 GW to reach 1.12 TW which is about 40% of the global total. Asia continued to dominate global solar capacity expansion with 56 GW increase, about 60 % of the total in 2019,

but this was lower than in 2018. China, India, Japan, Republic of Korea and Vietnam added most new capacity in 2019 as per IRENA report.

7.2. India's Performance in Clean Energy

Several millions of people in India do not have access to reliable, affordable electricity and they are often forced to use kerosene, charcoal and diesel in order to fuel their lives and thus polluting our environment with large amount of greenhouse gases. Also, the utilization of centralized power production from fossil fuels and nuclear energy, grid distribution, and long-distance transmission pose great difficulty to provide clean electricity to far off villages and hilly areas.

India has made a commendable progress in the new and renewable energy production. India is very ambitious in its targets for promoting renewable energy. In India, renewable energy has started playing an increasingly important role in the augmentation of grid power, providing energy access, reducing the consumption of fossil fuels and helping India to pursue its low carbon development path.

India's renewable capacity installations reached 86 gigawatt (GW) at the end of the year 2019 with wind energy became the biggest contributor with 44 % share in the total renewable energy mix followed by solar with 39 % share. According to the **Ministry of New and Renewable Energy**, Government of India, stands now at 5th Global position for overall installed renewable energy capacity.

The renewable energy has a share of 23.39% in the total installed generation capacity (370GW) in the country up to February 2020. Especially in the last 5-6 years, the solar capacity has been increased from ~2.6 GW to more than 34 GW. Our Indian Government has reduced the solar tariff more than 75% to meet the energy demand. India also embarked upon in setting up world's largest renewable energy programme for ~17 GW till 2022. **Ministry of New & Renewable Energy (MNRE)** is the nodal agency at the central level for promotion of grid-connected and off-grid renewable energy in the country. Ministry's programmes are

implemented in close coordination with State Nodal Agencies (SNAs) for renewable energy (RE).

Over the period, the SNAs have developed considerable knowledge and experience in planning and implementation of RE programmes. India is working towards achieving the goal of installing 175 GW of renewable power capacity by 2022 by setting a new target to increase the country's share of non-fossil-based installed electric capacity to 40 % by 2030. With a radical new approach, India is very confident to provide energy access to all people by 2030.

7.3. Status on the Clean Energy Programme at our Institute :

7.3.1 Establishment of Centre of Excellence for Energy

Recognising the importance of the clean energy as one of the primary sustainable development goals, **Sathyabama Institute of Science and Technology** has been focussing its R&D efforts in developing and demonstrating new energy materials and lab scale modules for the sustainable energy production and storage technologies such as solar photovoltaics, solid oxide fuel cells, super capacitors and photocatalysis. The institute has established “**The Centre of Excellence for Energy Research (CEER)** funded by the Ministry of Human Resource Development (MHRD), Govt. of India under the scheme of Centre of Excellence in the Frontier Areas of Science and Technology (FAST). It was inaugurated by His Excellency Dr. A. P. J. ABDUL KALAM, Former President of India on December 9th, 2014 in the august presence of Col. Dr. JEPPIAAR, Founder and Chancellor of the Sathyabama Institute of Science and Technology.

7.3.2 Aim and Objectives

The main objectives of this Centre of Excellence is to promote education, training, research and developmental programmes in the novel and newly emerging areas of energy research and to develop cost effective, efficient and sustainable technologies for the energy needs of the nation. The Centre also aims to enhance the quality and quantity of basic and applied research programs. The Centre organizes workshops/conferences for students, researchers, academic staff, and

scientists in India to further strengthen their expertise in the areas of energy research, to accelerate the India's human development index and to provide energy security.

The Centre is established in the International Research Centre (IRC) with facilities such as Raman Spectroscopy (Renishaw inVia Reflex Raman spectrometer), DEKTAK profilometer from (Bruker, USA), Potentiostat,- Galvanaostat with Impedance Analyser (Biologic, France), Hall Effect measurement system (Ecopia, South Korea), Raman Spectroscopy (Renishaw, United Kingdom), UV-Visible Spectroscopy (Jasco Analytical Instruments), 50L Biodiesel Pilot plant (Malnad Extraction Industries Bangalore, India), and Gas chromatography (YL Instrument South Korea). The major research laboratories established are Photovoltaics, Surface Physics, Energy Materials, Materials Chemistry, Materials Processing and Bio fuels.

7.3.3 Activities for the Promotion of Clean Energy

The Institute engages itself in several clean energy production and storage related projects in order to reduce the carbon emission. It renders the necessary support to cater to the needs of the Government bodies such as MHRD, ISRO etc. (please see Table 1). The scientists and research scholars are deeply involved in the development of heterojunction solar cells, perovskite based solar cells, intermediate temperature solid oxide fuel cell, oxide and nitride-based supercapacitors for energy production and storage. They have fabricated lab scale devices with advanced materials and have planned to upgrade the power capacity of the devices in future (please see the Table 2). Research is also in progress in the production of hydrogen using titanium oxide as photocatalyst for water splitting.

The Institute also has installed solar panels within the campus for creating awareness among students community. It is continuously making great progress in by publishing high quality manuscripts on clean energy in high impact International Journals (Please refer the list of publications-Attachment 1). Because of the excellent contact through Faculty and Student Exchange Programme with reputed foreign institutes, our researchers have contributed

significantly to update the clean energy programme and our Institute also has signed MoUs with Foreign Institutes who work on clean energy (Please see the attachment-3). Our Institute pays keen attention to organize Workshops, National and International Conferences on energy production and storage (Please see the attachment - In order to create awareness among research scholars, several Training/Orientation programmes were periodically conducted (Please see the photographs).

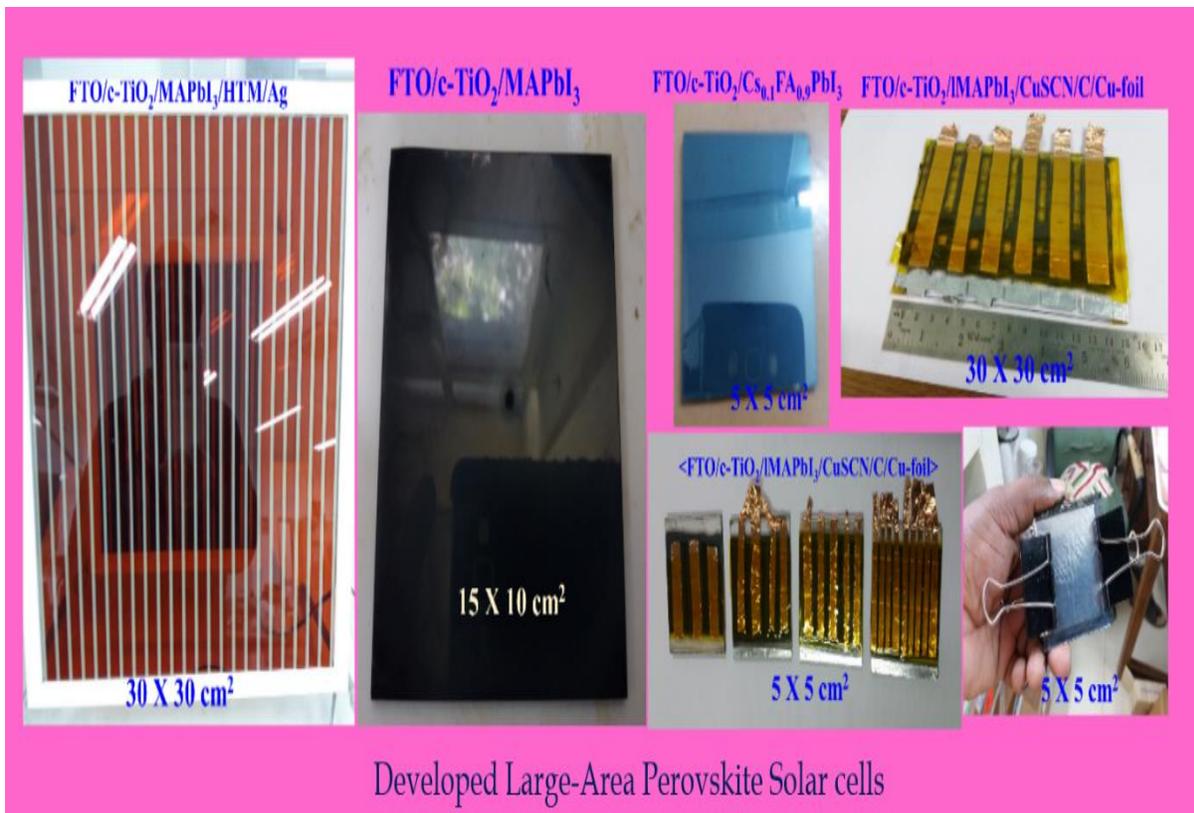
Support Materials

Table1: SANCTIONED PROJECTS

S. No.	Project title	Principal Investigator	Funding agency	Total fund (Rs.)	Duration & Status
1.	Development of Morphology-Controlled Transition Metal Sulfides Supported on Carbon-Based Materials as Advanced Electrodes for Supercapacitor Applications	Dr. J. Theerthagiri	ISRO	14,92,000	2019-2021 (Ongoing)
3.	Centre of Excellence for Energy Research (CEER)	Dr. T. Sasipraba Dr. P. Kuppusami, Dr. T.S. Shyju, Dr. S.S. Dawn	Ministry of Human Resource Development	2,50,00,000	2014-2018 extended till 2021

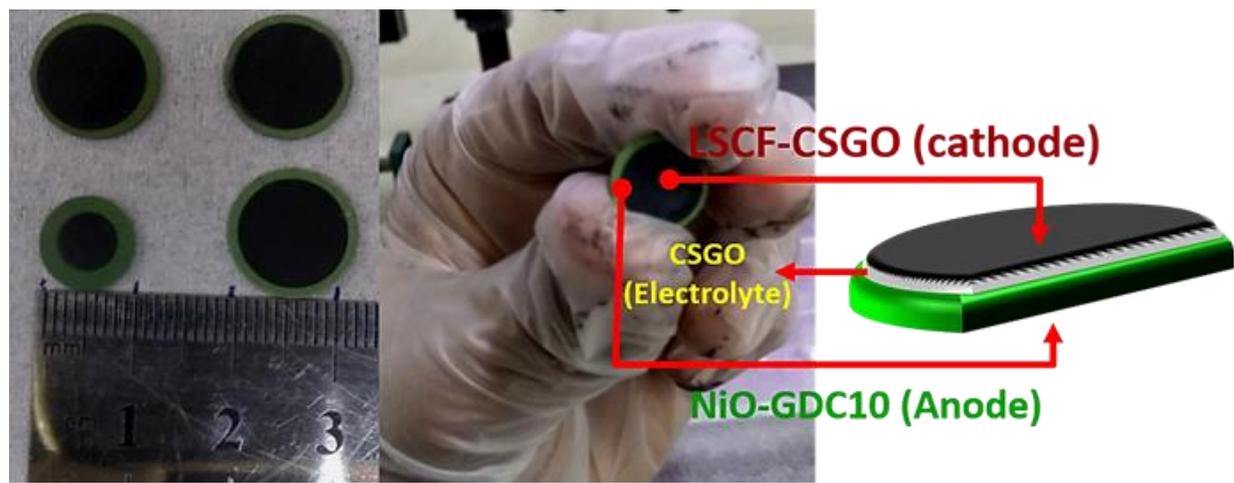
Table 2 Various Kinds of Devices Fabricated /Installed in Our Institute

Device	Power Output 2020	Power Output 2021
Heterojunction Oxide Solar Cells (Lab scale)	3 W	10 W
Thin Film Solar Cells (Lab scale)	10W	20W
Perovskite Solar Cells (Lab scale)	0.1W	5-10 W
Si based Solar Cell panels	10kW	50-100 kW
Ceria based SOFC	0.3W	1W



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maining



7.4. PUBLICATIONS

1. S. Ajith, P. Kuppusami , B. Vigneshwaran , Fu Yen-Pei, Co-doped (M= Sm^{3+} , Sr^{2+} , Ca^{2+}) and co-doped ceria- Na_2CO_3 nanocomposite electrolytes, *ACS Applied Nano Materials*, 2 (10) (2019) 6300–6311.
2. S. Ajith Kumar, P. Kuppusami, S. Amirthapandian, Yen-Pei-Fu, Effect of Sm co-doping on Structural, Mechanical and Electrical Properties of Gd doped Ceria Solid Electrolytes for Intermediate Temperature Solid Oxide Fuel Cells, *J. Hydrogen Energy*, (2019) (In press).
3. Training / Orientation Programmes



Training Programs for scholars, School Students and researchers

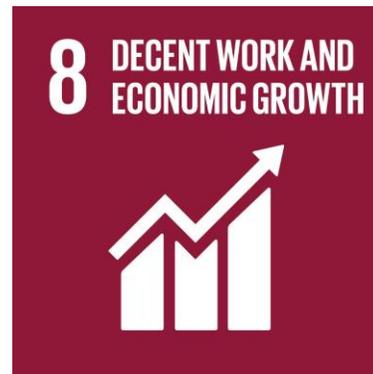


Orientation Programmes conducted for students and faculty

7.5. Research Collaboration

1. University of Hyogo, Japan – *Perovskite Solar Cells*.
2. Indian Institute of Madras, Chennai, India - *Storage applications*.
3. CSIR-Central Electrochemical Research Institute (CSIR-CECRI) - *Sensor and Storage applications*.
4. Technological Development Unit (UDT), University of Concepcion, Coronel Industrial Park, Coronel, Chile - *Water splitting applications*.
5. Institute of Natural Science and Mathematics, Ural Federal University, Yekaterinburg 620002, Russia - *Development of new magnetic materials*.
6. King Saud University, Kingdom of Saudi Arabia – *Photocatalytic Applications*.
7. National Dong Hwa University, Taiwan- *Solid oxide Fuel Cells to against the* developing research solutions and innovative technology• delivering behaviour change through instilling low-carbon values and habits in our students.

SDG 08 DECENT WORK AND ECONOMIC GROWTH



8.1 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

The University is committed to long-term goals that ensure creating, promoting and delivering opportunities that enhance the employability of suitable talent and students. Generating a sustainable pipeline of talent, providing access to the right tools and support for employees by giving individuals the platform to excel is critical to the long-term success of the university and its vital contribution to the community.

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all The full productive employment strategy is framed around developing and implementing simple and consistent processes and systems; supporting the evolution of the workforce, their engagement and wellbeing. The employment policies and practices are legally compliant and have enabled the University in retaining employees and sustaining its position as a fair employer since inception.



8.2 Graduate Employability

The graduates of Sathyabama Institute of Science and Technology are sought after employees, as reflected in the University's ranking in NIRF (INDIA) and the QS Graduate Employability Rankings 2020.

The University plays an important role in employment of graduates and job creation in India and across the world. Commercialization of the research findings of researchers has a high impact on the employment and entrepreneurial ventures of graduates whose growth and survival rates are above the national average.

8.3 Study Programmes

The robust Curriculum design of the University, accredited by National and International Agencies has promoted creation of responsible and ethical citizens. Global initiatives by the UN to promote Corporate Social Responsibility, Sustainable, Green Engineering and Management solutions are being meticulously disseminated through teaching-learning and research practices of the university. Periodic technology upgrades, innovation management and value added courses in the diverse disciplines have paved way for jobs which increase economic productivity.



Special focus on entrepreneurship, creativity and innovation is provided through Technology Business Incubators supported by the Department of Science and Technology (GOI) and Micro, Small and Medium Enterprises (GOI). Approaches fostering mission-oriented, inclusive, social innovation and digitally enabled innovation for sustainable development and growth of formal MSMEs with access to financial services have been enthusiastically acknowledged by various stakeholders.



8.4 Informal Student employment initiatives

The “**Earn while you Learn Programme**” launched from 2010 to offer interesting and varied career opportunities for students during their study period is a sought after initiative as it provides opportunities for skill development and work experience. Conscious contribution to basic literacy and open access to existing scientific and technological information, flexible intellectual property rules that allow fair use of physical spaces, online tools with hands-on learning and open repositories of scientific and technological knowledge is being practiced to achieve full and productive employment and decent work for all women and men including young people by 2030.



8.5 Integration of persons with disabilities

With increased attention to the principle of inclusive education for students with disabilities, systematic measures for the conditions in higher education have been incorporated. A transparent, fair and effective method of financing education through specific grants is in practice. Promoting and supporting integration of persons with disabilities through impartial standards regarding equal pay for work of equal value is the motto of the university.

8.6 Educational equity and community Development

Shared accountability and coordinated services integration in education, health and livelihood promotion has led to joint development and welfare of the local community. Various skill Development and Capacity Building programmes for poverty alleviation, promotion of small businesses, financial security, health and hygiene, physical and psychological wellbeing, literacy and safety of individuals for both men and women are being provided for economic inclusion and building up the local community and create assets and wealth for sustainability.

8.7 Strategy for Economic empowerment

The series of reforms and enablers of the Government in the Economic package to make India Atmanirbhar and measures for relief and credit support to businesses, especially MSMEs to support Indian Economy's fight against COVID-19 have been followed to address rural and urban employment generation activities. The startups initiated at the university have been

supported to contribute efficiently to the labour market with a distinct focus on inclusive and indiscriminative approach towards equity and sustainability.



SDG 09 INDUSTRY INNOVATION AND INFRASTRUCTURE



Creativity and innovation are new drivers of every nation's economy. Innovation is important to an organization as much as Quality. With the continuous effect from our active Institute Innovation Council we have secured fifth position in Atal Ranking of Institutions on Innovation Achievements (ARIIA), Ministry of Education (MoE), Govt of India under the self-financed universities category. We have conducted seminar, workshop, conference on regular focused towards innovations, Intellectual Property rights (IPRs), Creativity, Product Design and Development, Design Thinking, System Thinking and Conceiving — Designing — Implementing — Operating — (CDIO).



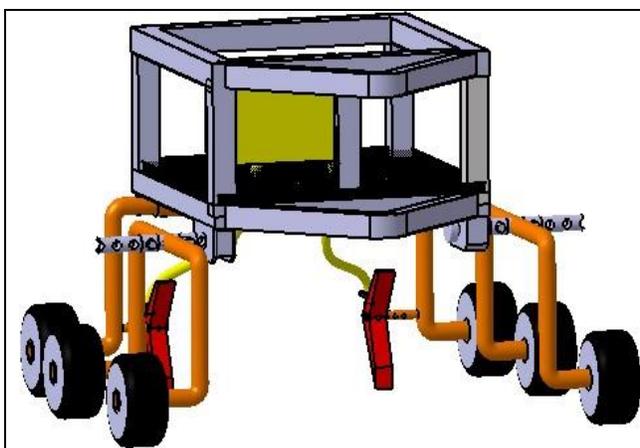
Organized a One day National Level Workshop on Sensitization on IPR for Professional Innovators in Electronics, Information and Communication technology on 22nd July, 2019 sponsored by the Ministry of Electronics and Information Technology. The Workshop was inaugurated by Dr. Sanjay Tyagi, Director, STPI, Govt. of India.



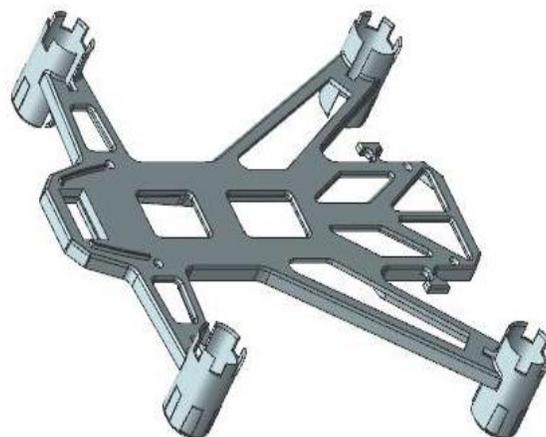
Organized International Conference on Intellectual Property Rights And Innovation Management (ICIPR2019) during 12th to 14th September, 2019 in association UNSYIAH Universitas Syiah kula Indonesia

9.1 Centre of Excellence for Collaborative Product Design and Development (CPDD)

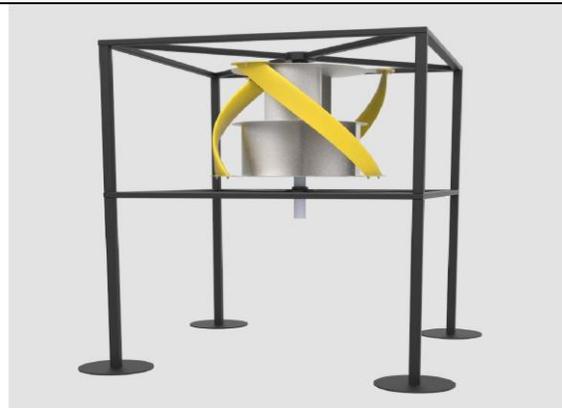
The creation of real product is an important for commercializing technologies arising from R&D at technical institutions. For example conversion of a Bolt & Nut from design into product requires 4-8 weeks. The master pattern can be selected only after testing the design of 34 patterns. That master pattern is used for production. Using Rapid prototyping we can select the master pattern in 4-8 hours. The Rapid prototyping requires construction of a mini plant. Institutions mostly lack of mini plant. Most of the Engineering Institutions have keeping Computer Aided Design Lab in different Location and Additive Manufacturing Laboratory (3 D Printer Lab) in different location. In this Situation, Design to Reality is very difficult. In Sathyabama Institute of Science and Technology, We are Integrated Computer Aided Design Lab and Additive Manufacturing Laboratory and developed new centre name as **Centre of Excellence for Collaborative Product Design and Development (CPDD)**. Through this CPDD, we have developed more than fifty products in the year 2019. Sathyabama have more than 20 successful patent/non patent technology transfer.



Multipurpose Agricultural Robot; Grant No : 317206-001,
Grant Date: 26/04/2019



Base Plate for Unmanned Aerial Vehicle, Grant No: 316200-001, Grant Date: 29/03/2019



Vertical Axis Wind Turbine Using Gorlov and Savonius Blades for Water Pumping System; Grant No : 294063



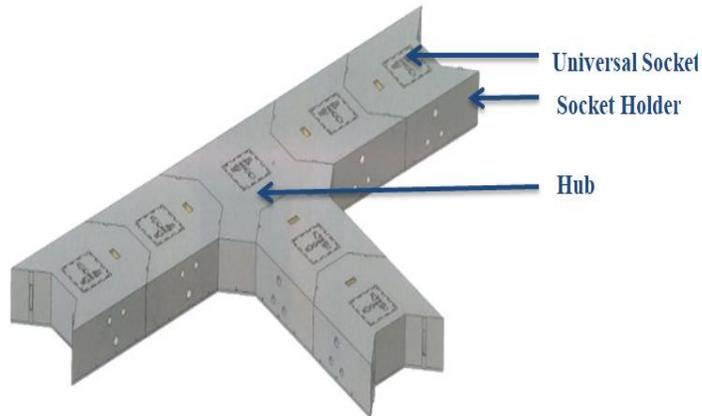
Tube Muffler for Light Motor Vehicle; Grant No :304750

Sathyabama is one of the top Indian Industrial Design (Design Patents) grant institutions in India. A growing trend in Intellectual Property Rights with Design Patents grants and Patents Published in effect moving responsibility for innovations.

IPRs	2017	2018	2019
Grants	7	4	63
Published	25	14	XX

Product : Extension Power Cord

Technology Transfer : CADD Technologies School of Design Private Limited, Coimbatore



9.2 Infrastructures for Innovations: Sathyabama Institute of Science and Technology has ventured into yet another digital initiative “NEXTGEN Lab” to empower students in cutting-edge technology. Pre Incubation and Product Development aspects, Sathyabama developed NI LABVIEW Laboratory, Spectroscopic facilities, Data Science and Centre of Excellence for Robotics and Automation.

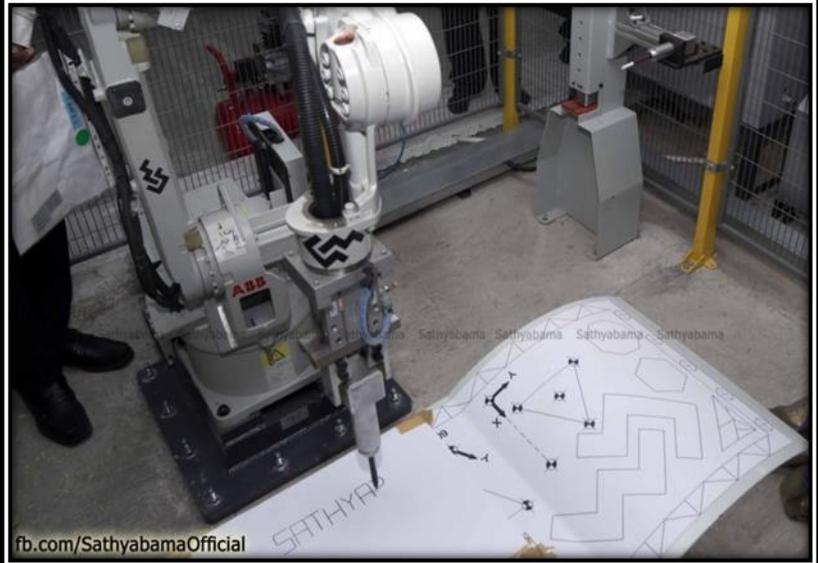


NEXTGEN LAB was inaugurated by Prof. Anil Sahasrabudhe, Chairman, AICTE on 28th July 2019. The lab features advanced technologies such as Augmented Reality (AR), Virtual Reality (VR), Artificial Intelligence (AI), Internet of Things (IoT), Blockchain and Data science.



Technovation – Technical Fest





The Center of Excellence for Robotics and Automation was established in 2019 to cater the automation knowledge needs in the field of robotics and Artificial intelligence. This center has an exclusive Industrial robot of ABB IRB 1520 (6 axis) to perform operations, programming, and advanced control systems.

Solar Infrastructure : Sathyabama Institute of Science and Technology has World's Largest Solar Steam Cooking System with 110 concentrator dishes with an area of 1100 m² (World's largest installation in terms of the number of dishes and square metres of the reflecting concentrator dishes). A solar-powered kitchen consumes lesser power and time than a conventional kitchen and ensures that a meal is cooked in half-an-hour, whereas it may take one-and-a-half hour to cook the same using LPG. Unlike the LPG model, solar steam cooking system helps to keep the kitchen clean and hygienic. This kitchen, by replacing LPG with solar dishes, saves nearly Rs. 20 lakhs every year. Out of 365 days in a year, Tamil Nadu experiences hot weather for 320 days and is ideal for tapping solar energy.



9.3 Industry Institute Interaction Cell: The aim of our Industry Institute Interaction Cell (IIIC) is to strengthen the relationship between industry and our institute, which provides an excellent platform for both the students as well as the faculty members to be aware of industry expectations from the graduates. IIIC serves as a podium to showcase the best practices, latest technologies in industry stand point and their implementation.



Industry Institute Interaction Cell Meeting

9.4 Executive Development Program: Sathyabama has well experienced Executive Development Program (EDP) for working professionals entitled with Quality Management, Production Planning, 5 S and Marketing.



Sathyabama Institute of Science and Technology has jointly associated with IGP Engineers, Chennai organized an “Executive Development Program on 5 S during 17th December, 2019. A total of 26 working professionals from various industries from the IGP group of Companies had benefited in the program. The Resource Person Mr.L. Pallaniappan, gave talk-on basic concepts of 5 S, History of 5 S and Step by step implementation of 5 S and detailed about 1S Seiri - Sort, 2S Seiton - Straighten, 3S Seiso -shine, 4S Seiketsu - Standardize, 5S Shitsuke – Sustain

SSDG10 REDUCED INEQUALITIES



10.1 INTRODUCTION:

Sathyabama University has always prided itself for its inclusive education. Students from all walks of life, religion, caste, creed and the differently abled too find Sathyabama inclusive. Even our employment policies have no discrimination based on the status of the applicant. The campus is very inclusive for all kinds of physical disabilities. From, ramps to interpreters and Brail books in the library, and the ever friendly attitude of the students and the staff makes inclusive education very easy. Sathyabama also prides in inclusion of high functioning Autistic students, who have benefitted by normal education in a regular college. The inclusion does not end with their academics. Sathyabama's placement Cell takes responsibility to place most of the differently able students in rewarding careers. In short their life is taken care of once they come to Sathyabama.



10.2 GOALS:

The main aim is to help differently abled students integrate with the society as a whole and not lose out on anything that the world has to offer. To reduce

the inequities that arise due to mental or physical disabilities, social and cultural differences, class differences and overall any differentiation that exists because of inhuman practices.

To help students from socially backward and downtrodden lives to create a future that is worth living. To uproot them from poverty and guide them to a more meaningful life.

To guide children of parents who are disengaged from the society, like prisoners, to be made self-sufficient and have a positive way of looking at life

To be a mentor and support system for students with physical disability to excel in any sport or activity that they are interested in.



Program conducted for Disabled students

10.3 Scholarship for Disabled Students:

Free education is offered to students from Ability foundation, an NGO that helps children with disabilities pursue education. Sathyabama has offered 50 free seats every year to Ability foundation. The total number of disabled students pursuing their graduation currently is 80. The hearing impaired students have interpreters who are also recommended by Ability and Sathyabama recruits them to help the students. The visually impaired and the students in wheel chair are also given the attention required. We also have occasional autistic students who have integrated well in the college because of the overall acceptance. Inclusive education for all has been Sathyabama's policy.



Interpreters interpreting the students

10.4 Scholarship for Meritorious Students from Socially and Financially Poor Background.

Sathyabama has so far helped more than 1200 students from very poor background finish their college education and has elevated their living standards. Sathyabama continues its Altruistic deeds and 2019 had 300 students who have joined us. These students will be given free education, free Hostel facilities and free transport. Some of the students who passed out and are well placed have made their Alma Mater proud by sponsoring students themselves. This compounding effect will make the ripples larger in our society and it brings immense pride to Sathyabama.



Chancellor with scholarship students

10.5 Arrangement with Global Network Equality :(Prisoners Welfare)

Sathyabama has an arrangement with the GNE (Global network Equality) who work with the prisoners and their children. Every year 25 seats are offered to them free of cost and we have children from broken families and prisoners who are accepted and offered all the facilities offered to the other students, but free of cost. Currently we have 48 students who are prisoner's children who are pursuing their graduation in Sathyabama. These students are given extra attention and care as they have had a traumatic childhood.

10.6 Facilities Offered

Starting with Ramps for students in wheel chair to interpreters for hearing impaired sathyabama strives to make life easier for students with disabilities. They are also included in the sports and cultural activities. One of our students Mr. Parthasarathy a wheelchair basketball player was provided with a sports wheel chair and he was



selected by London's Titans wheel chair basketball. Sathyabama bore his entire training expenses and his travel and stay there. Acid victim's students have been given life skill trainings and also psychological trainings to adapt to their state. The acceptance of those students in the college by the faculty and students has had a positive effect on their self-esteem and they are also given enough training to face the world with pride. Sathyabama's placement cell also helps them

find jobs as soon as they finish their graduation.



10.7 Support for Excellence:

- Our Student Mr. parthasarathy has been selected by London Titans Wheel chair Basketball club for an advanced training camp in London from 2nd – 25th March 2019.
- Sathyabama has proudly sponsored his sports wheel chair and his entire training expenses.
-

10.8 Grievance Cell:

Sathyabama has a Student's grievance cell which is a 5 member team. The students can approach the cell for any of their grievance and the matter will have to be resolved in 48 hours. The cell is opened on all days and students can approach them at any time during college hours. Regular meetings are held and the issues are discussed and they try finding ways to see that the grievances are minimized.

10.9 Placements for the Disabled:

Sathyabama's Placement cell has always tried and placed the students from the inequitable background in good organizations. They have signed an agreement with "youth for job foundation" which is a foundation that helps disabled students get good jobs. The endeavour does not end there. The placement cell has been conscious of the fact that these students has it rough when they go into the society and hence, special counselling is offered to them and the organizations that recruit them are also given an orientation of how they could be Disability friendly organization. Students from socially weak background are given training in Soft skills.



SDG11 SUSTAINABLE CITIES AND COMMUNITIES

11 SUSTAINABLE CITIES AND COMMUNITIES



11.1 Leading by example , we provide a sustainable campus



Sustainable Practices within the campus

1. All students and faculty members use sustainable transport means to commute to college, these are through buses that use Bio-diesel generated from waste oil collected from college kitchen
2. Pedestrian-friendly and pollution free campus with natural ecosystem of wetlands surrounding the campus, only battery-operated vehicles are mainly used inside the campus
3. Mass Tree plantation was conducted by college in the area Thiruvarrum and in the college by around 1000 students on 27th Jan 2019.
4. Water treatment plant has been established in the campus that is used for irrigating the landscape in the campus
5. Renewable resources are utilized in the campus like Solar energy for street lighting, charging points, solar heater for hostels.
6. Road traffic awareness program was conducted by students as a NSS activity on

2nd Feb and 9th Feb 2019 in Sholinganallur, Chennai.

11.2 Contribution to Sustainable development of city

1. Engineer J . Vanjinathan, Assistant Professor in Department of Civil Engineering has been appointed for State Quality Monitor in TUFIDCO (Tamilnadu urban finance Infrastructure development and corporation).

He was involved in the project appraisal in TUFIDCO (Tamilnadu urban finance Infrastructure development and corporation) for the following projects;

- Development of commercial complex at Thiruvallur theatre under Smart Cities Mission
- Redevelopment of new stand in Vellore City Municipal Corporation under Smart Cities Mission
- Convention center at Tamukkan ground Madurai smart city
- Bridge project under IUDM 2019-20. Alandurai Town Panchayats



2. School of Building and environment signed a **MOU, with ITDP** Institute of Transportation and development policy, Chennai, to collaborate in working towards **planning Sustainable transportation** in Chennai.

Our students worked for **Complete street project** and prepared proposals for pedestrian infrastructure in the influence area of schools in Mylapore and Saidapet areas in Chennai.

11.3 Centre of Excellence in Urban Climate and Built environment

1. School of Building and environment, Department of Architecture has established Centre of Excellence in Urban Climate and built environment which possesses a well-equipped

Climatology lab, with instruments like Thermal imagers, data loggers, outdoor data loggers and simulation software like IESVE, ENVIMET etc. , here simulation studies and research works on Sustainable practices topics like building materials, energy efficiency in the building, urban heat island, sustainable landscape planning are conducted and documented.

2. Students underwent Internship and collaborated for the following Govt. proposal – Post occupancy evaluation for Zero peak energy design for India during May 2019 to December 2019.

11.4 Capacity building programs

The University has a continuous cycle of Programs that bring about transformation in the campus through the delivery of state of art research, training and improvement in teaching methods and facilities some of which are;



1. **Faculty development programs**, are conducted, like **Urban Climate and built environment** was conducted in association with Council of Architecture (COA) on 4th March to 8th March 2019 where all experts from various cities came together and collaborated, shared their knowledge and trained the participants.



2. In order to Strengthen the awareness and efforts to protect and safeguard **cultural and natural heritage of Chennai** city every year **Madras day** is celebrated, conservationists and Architects working in this domain are invited to come and share the experience. Competitions are held were in the culture of Madras is celebrated.



11.5 Sustainability as an integral part of Academic learning

The Academic learning has been developed with the intent to provide professionals and students with a springboard for invention, knowledge and understanding of the application of an integrated environmental approach in sustainable architecture design.

To equip the students with knowledge to respond to a changing world and environmental challenges for best performance in the Industry as Sustainable Architects, Green Auditors, and Green Building Professionals.

1. School of Architecture offers Post graduation program on sustainable architecture and Building Management. The Sustainable goals have been incorporated in the curriculum and students get exposure through various studies and live experiments conducted.
2. Students in Master program in Sustainable Architecture and Building Management can cater to sustainable city planning and design through their academic curriculum and studios which prepare them for sustainable design and construction, enhancement of building services , Intelligent building management systems
3. Professional Training conducted for Post-graduates and Under-graduate programs enable the students to get exposure by working with renowned Architects, Sustainable Architecture firms, Construction Industry.
4. Under Graduate program in Bachelor of Architecture has been structured to include subjects related to Sustainability like Sustainable Architecture, Energy efficient architecture, Vernacular Architecture, Landscape Architecture, Site planning Conservation.

Sustainable development workshops

1. Green Rating system workshop was conducted for students by Ar.Kuladeep Kumar on 26th June 2019 organized as part of the Master Sustainable Architecture Program curriculum.
2. Bio-Resilient complaint HVAC system can improve the wellness of occupants & Heat load calculations by D. Balaji Partner Shree SRB and Associates HVAC Consultants on 31st August 2019

3. Bamboo construction workshop 25th Jan to 2nd Feb 2019



4. College is a member of Indian National Trust for Art and Cultural Heritage (INTACH) and participates in the activities conducted by INTACH.
5. Developing the students as Green Professionals that will create more awareness in various cities towards sustainable development



11.6 Yearly Academic exercises

1. Rural Studio in Andhra Pradesh– July – Nov 2019 for III Semester BARCH students

As a part of their curriculum the III semester Architecture students work on selected RURAL villages. They document the entire village and study about the Socio economic status of the village. Students as teams tried to understand the basic infrastructure facilities available in the village. With the available data they proposed small design interventions to address the issues. Through this exercise they understand the relationship between human need and built environment. They generated logical conclusions based on their detailed study.

The Araku valley region comprised of many tribal villages around. Araku is 100 km from Visakhapatam and its altitude is about 1300m above the sea level with rich vegetation and an interesting ecosystem. The study presents a comprehensive understanding about various design strategies, construction material and built form.

An intensive study was carried out by the 2018 – 2023 batch students of Architecture. They have utilized the knowledge gained from core courses like Vernacular Architecture, society culture and environment and Building Material in developing following spatial configuration. Students were guided to Integrate sensitivity in design approach in community-oriented projects with respect to context, collective values and needs.

The proposals made are:

- Tea shop
- Fertilizer storage and sales shop
- Fruit market
- Polyclinic
- Community centre

Rural Studio



2. Urban Studio – TOD- July – Nov 2019 for IX Semester BARCH students

As part of the academic exercise, our students participated in identifying issues in the city and give proposals for the same.

As part of urban design studio, transit oriented development proposals, connections and interventions in urban spaces near the upcoming metro station in Chennai was studied and Design incorporated place making principles and integrated the needs of commuters by supporting social interactions and exchange. It reflected the networks role as a social space, the impact of this intervention, and the unforeseen dimension of Architecture and Urban design.

The studies were conducted in the neighborhood of proposed metro stations at Sholinganallur, Perungudi, Siruseri, Villivakkam, Vadapalani, Iyyapanthangal.

The output focused on Design of station with proposed amenities for the identified location with a challenge to showcase the Imageability and make an identity for the Chennai city.

Development of Area with connectivity to the adjacent neighbourhood which included Utilization of open spaces and development of vibrant interactive spaces.

3. Master Sustainable Architecture Design Studio – study of the building blocks in Sathyabama campus and analysing the building envelope.

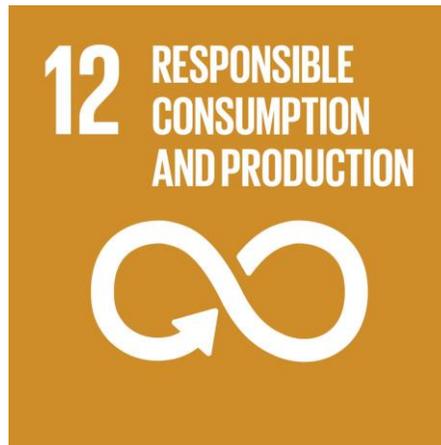
Students in groups studied various building blocks in the campus, the existing conditions were evaluated, took measurements for climate parameters like temperature, relative humidity and wind velocity.

After the analysis through various simulations for the building envelope, material and cost analysis, they proposed design solutions to achieve indoor thermal comfort.

Research papers on this design studio were further published in reputed journals by the students.



SDG12 RESPONSIBLE CONSUMPTION AND PRODUCTION



With the Centre for Waste Management playing a key role the School of Bio and Chemical Engineering, the School of Mechanical Engineering, the School of building and environment through their research objectives, projects, training programmes and other related activities have always promoted the use of services and products bringing a better quality of life while still pertaining to lesser utilization of natural resources and toxic materials. The institution functions with the focus of developing processes and products that give away lesser waste and pollutant emissions thus meeting the demand of Responsible consumption and production.

The holistic approach of Sustainable Consumption and Production is built around the following objectives:

12.1 Objective 1: Decoupling environmental degradation from economic growth.

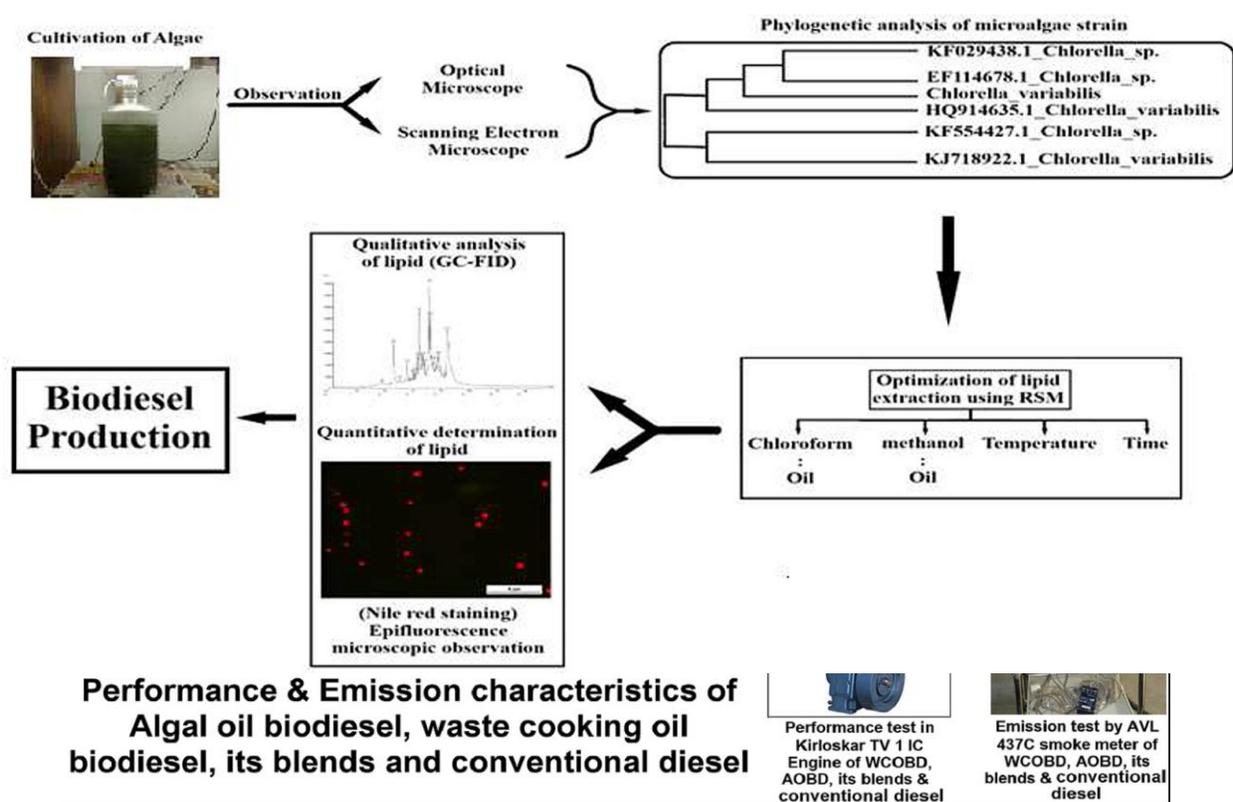
The Centre for Waste Management, a Centre of Excellence for Energy Research (Bioenergy) has operated Rs.1,00,00,000/- worth projects and continues to operate projects related Waste to bioenergy Conversion technologies

i) **by pursuing feasibility studies at the lab/bench/pilot scale for the production of biodiesel** from various non-edible sources like jatropha/pongamia seeds; animal fat like beef tallow, Newzealand sheep skin; Microalgal lipids and Waste Cooking Oil of different origin. The studies have resulted in the preparation of Biodiesel from Waste Cooking Oil generated in the Sathyabama Institute of Science and Technology mess, which caters to the food need of about 10,000 inmates. This research measure not only has diverted the use of Waste Cooking Oil for fuel production but has also contributed indirectly to the reduction in usage of conventional petroleum crude (natural resource) for the production of diesel. A 50 litres pilot plant established in the Centre for Waste Management Laboratory produces on an average 90-96%

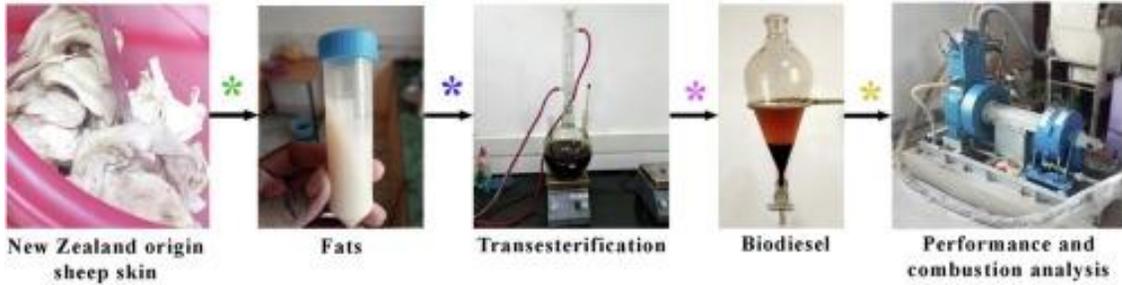
yield catering to the need of five of the institution's buses to operate with 12% blend. The usage of the blends in the buses have proved successful, the laboratory, bench scale and pilot scale biodiesel produced to have better performance and lower emissions.

ii) **The results have been published in peer-reviewed journals given below:**

- Alok Ranjan, Dawn.S.S, J. Jayaprabakar, N. Nirmala, K. Saikiran, S. Sai Sriram, Experimental investigation on effect of MgO nanoparticles on cold flow properties, performance, emission and combustion characteristics of waste cooking oil biodiesel, Fuel, <https://doi.org/10.1016/j.fuel.2018.02.057> [I.F:4.908]



. Jayaprabakar, Dawn.S.S, A. Ranjan, P. Priyadharshini, R.J. George, S. Sadaf, C. Rajeswara Rajha, "Process optimization for biodiesel production from sheep skin and its performance, emission and combustion characterization in CI engine", Energy, ISSN: 0360-5442 [I.F: 4.968]



- ✱ - Extraction of fat from New Zealand origin sheep skin
- ✱ - Conversion of fat into biodiesel
- ✱ - Processing of fat for transesterification
- ✱ - Biodiesel for engine testing



Calorific Value : 36,283 (kJ/kg) Diesel : 39,865 (kJ/kg)

Brief Report on Pilot Scale Bio-Diesel Production Plant	
Raw material Used	Mixed Waste Cooking Oil of FFA < 4 %
Operating time	1.5 hours
Temperature	60° C
Methanol to Oil Molar ratio	4.5 : 1
Catalyst	0.5 weight %
Yield	98%

Patent awaited Technologies in terms of less impact on resource use, environmental degradation, waste and pollution developed in the Centre for Waste Management

- a) Analysis and Development of Bio Plastic from Algal Biomass for Composites
201641037330 (First Examination Report submitted)**

12.2 ABSTRACT OF THE INVENTION

This project deals with “Formulation of Biopolymer from algal biomass as an alternate to Conventional Plastic” by Using Natural algae biomass”. Algae are predicted to play an important role in tomorrow’s bio economy. Microalgae flourish in municipal wastewater treatment ponds, where they perform a waste purifying function, but harvesting of the algal biomass is generally not practiced, and where it is the chemical flocculants used to remove the algal cells limit further uses of the algal biomass, even for bio fuels (e.g. anaerobic digestion for methane generation). Many research scholars concentrating for the production of bio fuel/bio mass by natural algae. But this project deals about formulation of Biopolymer from algal biomass as an alternate to Conventional Plastic from wasted algae biomass. Wasted algae bio-mass are our raw material for making an alternate conventional plastic. Through chemical synthesis process we are able to make alternate from raw materials. This project is totally new innovation in the area research and development of waste material as well as new composite materials and this could be definitely

useful for common people because of low cost and eco-friendly.



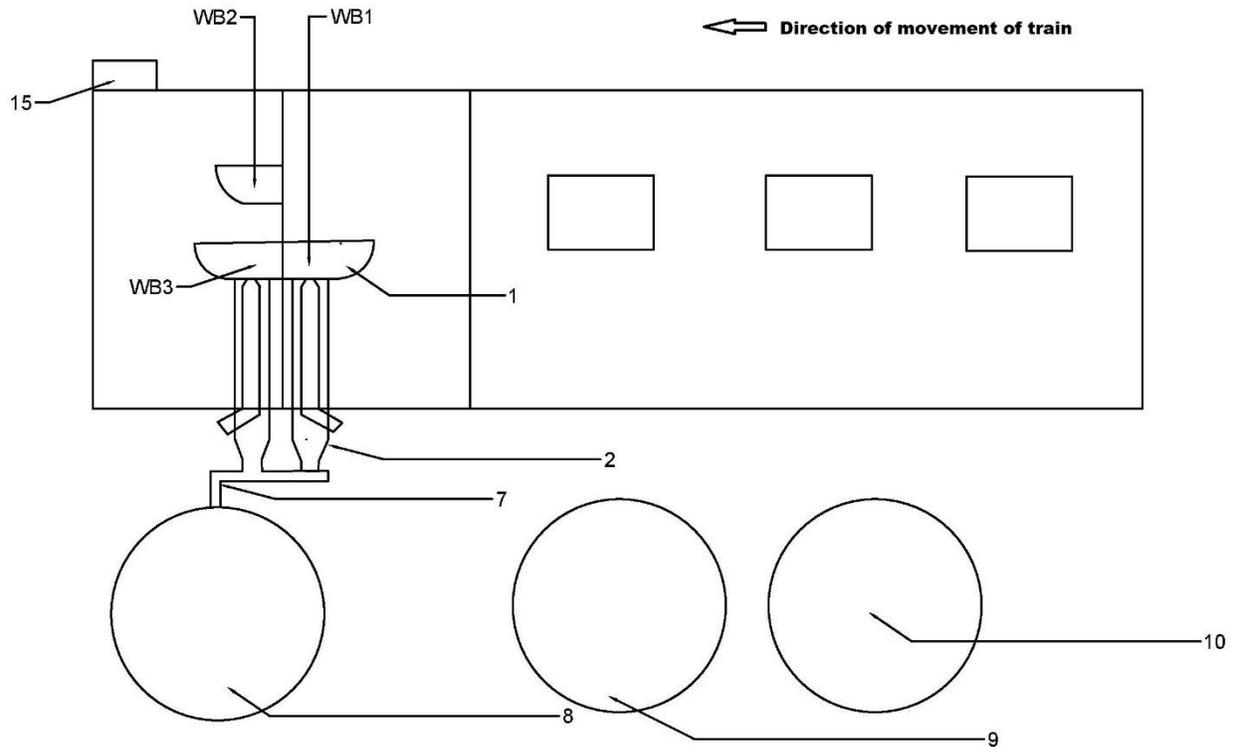
Automobile components made from algal reject

- b) Compact Sensor System for Train
Compartment Washbasin Water Recovery
201641037331 (Final Examination Report
Submitted)**

12.3 ABSTRACT OF THE INVENTION

In this growing technical era, we are forgetting the elementary thing which supports the existence of human race that is WATER. Now a day the society faces a major problem in the form of “WATER SCARCITY “. But on the other hand we waste a huge volume of water every day at some places. One of such places is the Indian railway where lakhs and lakhs liters of water get wasted every day just after a single use. In India average number of passenger trains running is 12617, which carry about 23 million passengers a day and 8.397 billion passengers annually. At an average 24 coaches are there in a long distance trains. Water is stored in the reservoirs at the time of departure of train (1800 litres/coach) and refilling of tanks is done after 250-450 km. But the water is not efficiently utilized. After a single use it gets wasted on railway tracks and it becomes unfit for further use. The thing is that the water which falls on the track is unable to penetrate even to the water table because of the highly compact concrete and stones which are used while constructing the tracks, so it becomes useless. Water from the wash basins are the major offender of waste water during travel.

In order to meet the demands of water for the growing population of our country we need to harvest this water from being wasted. To do so we can make certain changes in the construction of the water tanks and the wash basins of the trains of India. As per the proposed system the water tanks can be divided into three chambers both of them should be separated by the non-permeable flexible membrane which will also act as the divider between the water (used & fresh) in the tank. As the volume of fresh water decreases, the place to store the filtered used water increases, so in this way the same tank can be used for storing the freshwater as well as the used water. Water from the wash basin is passed through a filter. Purity of the water will be tested at filter outlet.



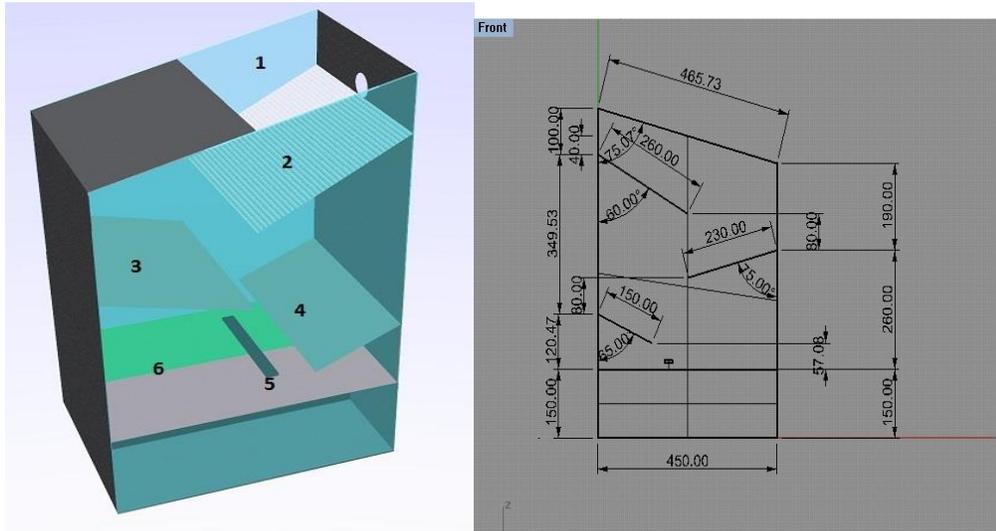
Scheme of Wash basin Water treatment in Railway Compartment

c) Automatic Smart Segregator 201641037332 (First Examination Report submitted)

12.4 ABSTRACT OF THE INVENTION

About 0.1 million tonnes of waste is generated in India every day, which is approximately 36.5 million tonnes annually having composition of organic waste- 40-60%, plastic, paper, cardboard, metal, glass- 12-28% and other wastes 12-47%. 95% of the municipal waste collected is dumped on land with only 5% being composted as a result of which the landfill sites are growing drastically, so adverse that even airport authorities' permission is being requested to further extend the height of landfill sites. The researchers suggest for opting a different route of utilizing easily available efficient techniques such as waste-to-waste conversion techniques, recycling processes, bio-gas plant, but the only limitation is that these all demands raw segregated waste for their successful operation and once the organic waste is mixed with inorganic and hazardous waste it's almost impossible to achieve efficient segregation. Establishing segregation plants is limited by need to large area of land, high cost machinery, heavy power requirements, so other way to look into the problem is to ensure source segregation right at the point of origin. We

propose an automatic and smart concept of self-sorting thrash bin, which is capable enough to sort the waste into organic waste and recyclable waste.



Configuration of Automatic Smart Segregator

12.5 Objective 2 : Other Waste to Valuable Material Recovery technologies/processes/products developed in the Centre applying life cycle thinking.

The Centre took initiatives to develop sustainable management of resources and achieve resource efficiency along both production and consumption phases of the lifecycle, including resource extraction, the production of intermediate inputs, distribution, marketing, use, waste disposal and re-use of products and services.

Product 1 :Waste Cooking Oil to Detergent Soaps and Bioglycerol to Liquid Soap

Benefits: No lathering agent addition, Removes dirt with less water requirement , Simple process, Suitable for being made with low investment through microenterprises, Potential income generating technology



Outcome : Project sanctioned

Eco Friendly soap from used cooking oil and Liquid Soap from bioglycerol two projects funded by Unnat Bharat Abhiyan, Centre for Rural Development and Technology, Indian Institute of Technology, Delhi.

Product 2 :Organic pots from food waste and coco peat



Food waste



Cocopeat



Mould

Figure 1 : Collected Food waste and Cocopeat



Figure 2: Mould and Mixing the ingredients



Figure 3: Filling into the mould



Fig 3 Sun Drying



Fig 4: Dried pot



Fig 5: Onsite training (pot making)

Outcome: Project Sanctioned

A Technology Development for waste to organic pots- a replacement to sapling distributing polythene bags funded by Unnat Bharat Abhiyan, Centre for Rural Development and Technology, Indian Institute of Technology, Delhi.

Product 3 :Ritual Waste to Incense sticks

Recycle of **Ritual Waste Materials to Incense Sticks**- an Eco-friendly Approach for Rural Industrialization and Entrepreneurship Development, Sensitivity: Internal & Restricted funded by Unnat Bharat Abhiyan, Centre for Rural Development and Technology, Indian Institute of Technology, New Delhi

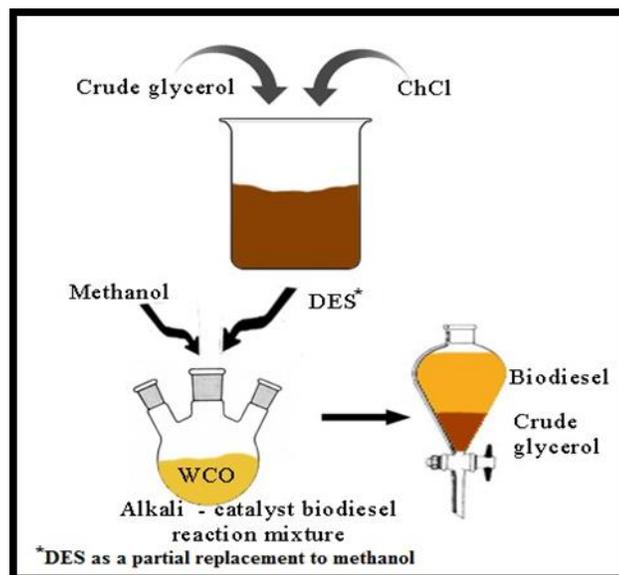
Training Self Help Group Women to make Incense sticks from Ritual Waste,Kumizhi Village ,July 2019-September 2019



Outcome :Establishment of POOMANAM, Microenterprise establishment at Kumizhi,19th September 2019



Product 4:Green Solvent (Deep Eutectic Solvent-DES) Synthesis from bioglycerol recovered as a byproduct from Biodiesel production

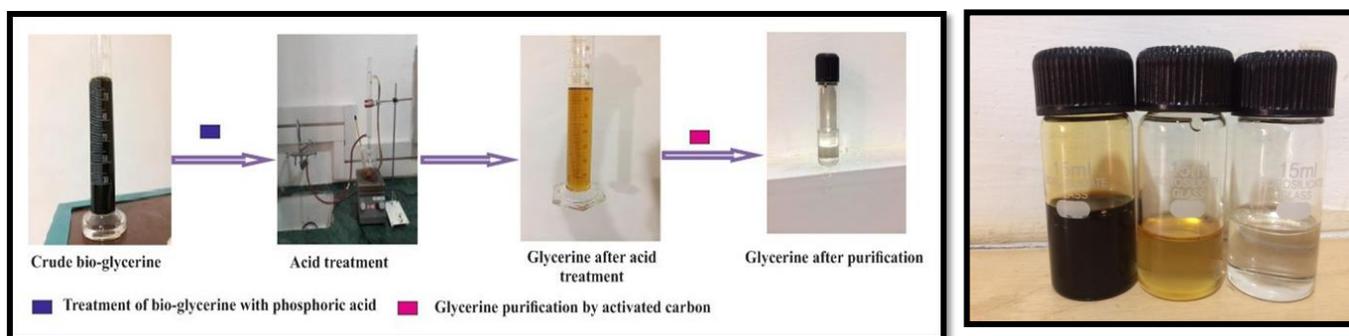


Outcome: Green Solvent Synthesis

The DES thus prepared is used as a partial replacement for Methanol in transesterification reactions for biodiesel synthesis and used to capture CO₂ reducing global warming thereby mitigating climate change. The results are published in

CO₂ Capture Using Crude Glycerol- Derived Deep Eutectic Solvents ., R. Alok, Dawn.S.S, N.Priscilla, R. Priyanka, A. Joshua., Springer Proceedings in Energy, pp: 735 – 743.
https://doi.org/10.1007/978-981-15-2662-6_66

Product 5: Refined bio-glycerol for heat transfer applications



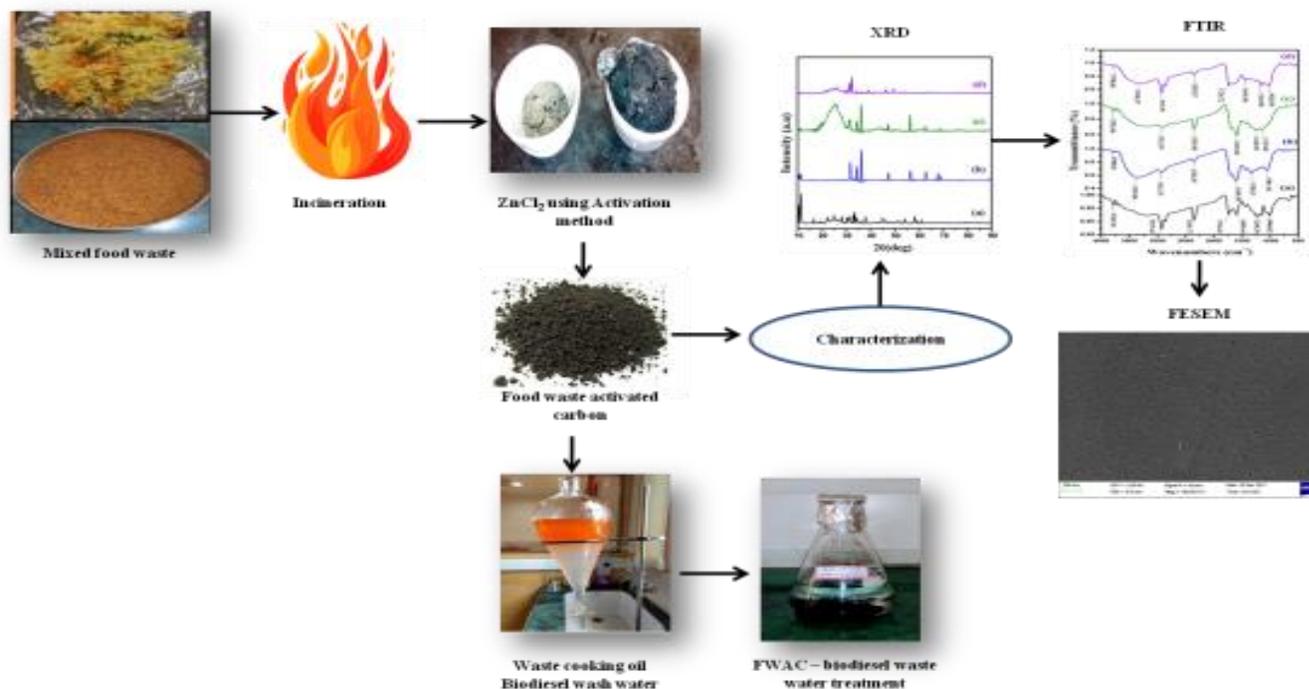
A process was developed to treat crude glycerol obtained as a byproduct from transesterification reaction in the due course of producing biodiesel, which has good value as an industrial product of significant purity.

Outcome: Can be sold as a heat transfer fluid having a good market value.

Product 6: Activated Carbon from Food Waste

A technology has been developed to convert food waste to activated carbon which is potentially used in the treatment of biodiesel wash water thereby making the process a closed circuit one by providing a solution to recycle and reuse the water for washing of crude biodiesel. The work is published in a Conference Proceeding

A.Santosh, **Dawn.S.S** “Simultaneous thermal analysis for the selection of mixed food waste as precursors for activated carbon synthesis”, International Conference on Recent Advancements in Chemical, Environmental and Energy Engineering (RACEEE 2019), 42-44



12.6 Objective 3 Sizing opportunities for creation of new jobs and poverty eradication

The Centre has been instrumental in disseminating the processes, products and technologies pertaining to Sustainable Consumption and Production, thus being an eye-opener to the younger generation of a developing country like India to show case opportunities such as the creation of new markets, green and decent jobs as well as more efficient, welfare-generating natural resource management by conducting conferences, training programmes, workshops, awareness programmes, exhibitions etc.,

12.7 Conference/Awareness Program/Workshop/ Training Program/ Seminar Organized

- Monthly Training Program on “Pilot Scale Biodiesel Production & Characterization” on monthly basis funded by Ministry of Human Resource and Development (MHRD) since July 2019 (No.of Training conducted: 2)
- Hands- on Training on Algae extraction for Bio-fuel Production Technologies (ABT – 2019) on monthly basis by Centre for Waste Management, Sathyabama Institute of Science and Technology (No.of Training conducted: 2)

- Two Days Hands – on Training on Microbiology Techniques by Centre for Nanoscience and NanoTechnology & Centre for Waste Management, Sathyabama Institute of Science and Technology during 22nd & 23rd August 2019.
- An Awareness Workshop on Solid Waste Management Challenges towards Healthier Environment (SWACHH) for Group A & Group B officers of Controllerate of Quality Assurance (Heavy Vehicles), Ministry of Defense, Avadi during 18th March 2019.
- Corporate Actions & Responsibility towards Environmental Sustainability (CARES) organized for Korean intern students from Hyundai during 18th February 2019.



SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
Centre of Excellence of Energy Research
Centre for Waste Management
One Day Hands-on Training on Biofuel
Production & Characterization





SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
Centre of Excellence of Energy Research
Centre for Waste Management



**One Day Hands-on Training on Gas Chromatography
GC-FID/TCD**

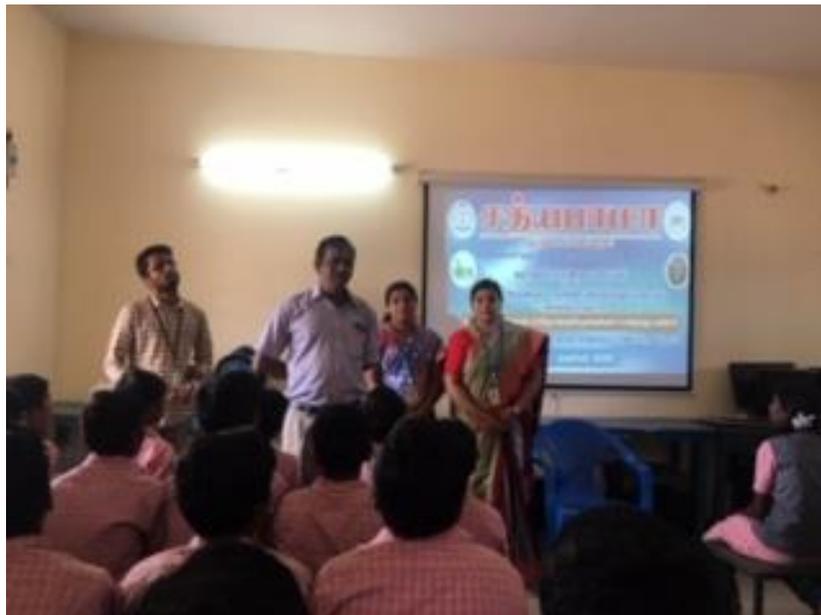


12.8 Societal outreach program

Awareness on Waste Management to Self Help Group Women of Kuthambakkam, Poonamalee Block , 24th August 2019



Awareness Training on Novel Technology based Entrepreneurship Development to High School Children of Kumizhi, 12th July 2019



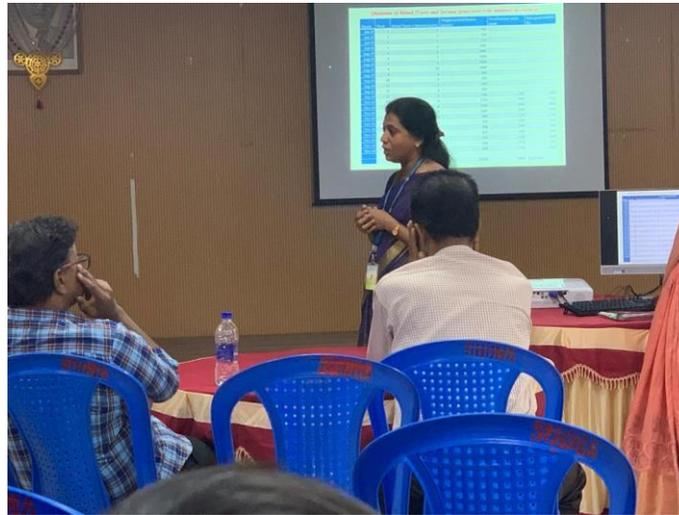


Awareness given to Anganwadi Children on Segregation of Waste at Kumizhi Village





**Pasumai Eriporulum Adhan
Athyavasiyamum Sirappu
Vizhipunarvu Mugam,
Mattapalli, Krishnagiri (Since
October 1st , 2016 till date)**



Appeared before the committee on 28th December 2019

12.9 Memorandum of Understanding

Signing of MoU between Sathyabama Institute of Science and Technology and VANS CHEMISTRY PVT. Ltd., A E-Waste Management Company for the establishment of E-Waste Collection hub to facilitate Refurbishment



and production

By pursuing the activities pertaining to the objectives 1,2 and 3 discussed above, Sathyabama Institute of Science and Technology through the Centre for Waste Management will

- a) Contribute to India's shift towards sustainable consumption
- b) Achieve sustainable management and efficient use of natural resources by 2030 thereby having the expected Material footprint, material footprint per capita, and material footprint per GDP
- c) Have a reduced Food Waste Index by translating food waste recycling technologies for fuel production and activated carbon synthesis, thereby diverting waste to useful product of higher value.
- d) make the collaboration established with Vans Chemistry fruitful to handle E-Waste which is hazardous. The Institution will jointly develop a technology in handling the hazardous e-waste by translating the preliminary work done on recovery of Mercury from Compact Fluorescent Lamps part from establishing an E-Waste Collection hub.
- e) will focus on establishing startups related to Waste Management and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment by 2030 .
- f) will substantially reduce waste generation through prevention, reduction, recycling and reuse within the institution and also develop strategies and protocols jointly with environmental management companies like Wasmanpro Solutions, Vans Chemistry, Transenergitics etc., to reduce waste disposal, increase recycling rate by encouraging companies to adopt sustainable practices.
- g) Promote public procurement practices that are sustainable, in accordance with national policies and priorities
- h) involve in outreach activities, training programmes, workshops and conferences among different beneficiaries and stake holders including students, teachers, industry personnel

and general public to render relevant information and awareness for sustainable development and lifestyles in harmony with nature

- i) implement renewable and alternate energy technologies in large.
- j) promote sustainable tourism in Chennai where the institution is located by implementing green concepts in terms of clean energy usage (biodiesel from Waste Cooking Oil), waste management in hotels (Biogas from food waste) promoting Installed renewable energy-generating capacity.
- k) acquire subsidies for implementing sustainable consumption and production

The Centre for Waste Management, Sathyabama Institute of Science and Technology as an academia has already

- 1) Established practices of waste sorting, waste collection, recycling, concept of 'Circular Economy' and 'Resource Efficiency' in school and college/university curriculum
- 2) Undertaken research on resource flows, life cycle analysis, secondary materials and provide capacity building and ventured into technical support for setting up MSMEs/start-ups in the waste sector
- 3) Introduced short training courses on different aspects of resource efficiency such as resource efficient designs, recycling and waste reduction in all public administration, health, engineering, training and education programs
- 4) Engaged in multi-disciplinary research and development, establishment and testing of developed frameworks and tools to address the implementation and challenges of resource efficiency

SDG 13 CLIMATE ACTION



13.1 WHO WE ARE?

The Centre for Climate Change Studies (CCCS) was established in the year 2011 at International Research Centre (IRC) with the primary mandate of investigating the impact of predicted climate change on marine organisms associated to various ecosystems like coral reefs, sea grass meadows, seaweeds, intertidal zones and mangrove ecosystems etc. In addition, we are committed to achieve United Nation's Sustainable Development Goals (SDGs), mainly SDG 13 and SDG 14 that cover's Climate Action and Life Below Water by 2030.

At present, in the CCCS, the following activities are going-on: (i) Implications of climate change on natural life history traits of coral reef caridean shrimps; (ii) Response of micro-planktons to elevated temperature and decreased pH using multidisciplinary approach including proteomics, biochemical and physiological assays; (iii) Contribution of seaweeds towards sustainable future by playing a role in climate change mitigation and adaptation; (iv) Diversity and status of coral reef shrimps in Gulf of Mannar Biosphere Reserve, Tamil Nadu and Lakshadweep and (iv) Plant-insect interaction under climate change scenario. Besides, the Centre is also instrumental in spreading awareness about conservation of marine ecosystem to schools and teachers through citizen science program.

Researchers at CCCS have been actively working at Sathyabama Marine Research Station (SMRS), recently established at Rameswaram to encourage research on cutting-edge marine ecology and climate change to sustainably use, manage, and conserve natural ecosystems for the benefit of the coastal communities of Gulf of Mannar and Palk Bay regions.



13. 2 RESEARCH AREAS

Taxonomy, Genetics, and Eco-biological Studies of Coral Reef Dwelling Fishes and Invertebrates

My primary model systems are coral reef fishes and caridean shrimps, especially when it possesses an ornamental value and symbiotic relationship with other organisms. The representatives of coral reef fishes and caridean shrimps mainly occur in the tropical and sub-tropical latitudes, in shallow-water habitats with the highest diversity found in Indo- Pacific and Atlantic region. This remarkable diversity has driven these organisms to various lifestyle adaptations such as morphological, physiological and behavior. Using a broad approach combining taxonomy, genetics, and eco-biology, we try to answer questions such as:

How the physiology, biogeography, and evolution drive the diversification process in reef organisms in the pan-tropical reefs?

Do these organisms undergo physiological and molecular adaptations to rapidly changing climatic conditions?

How could the ornamental fisheries in India be sustainably utilized for the benefit of fisherman's livelihood and in parallel conserving natural stocks in the wild?

In view of the above, I am working on four major research areas.

1. *Integrative taxonomic approach to document the cryptic species diversity*

This study focuses on revealing the cryptic species diversity in the coral reef associated crustaceans. For instance, the cryptic species complexes of the ‘peppermint’ shrimp *Lysmata wurdemanni* have been revealed based on the integrative taxonomic approach. The main highlights of the research reveal that genetic diversification is not always correlated with phenotypic dissimilarity, resulting in cryptic species complexes that pose a major challenge for biodiversity cataloguing. Resolving these complexes is of utmost importance.

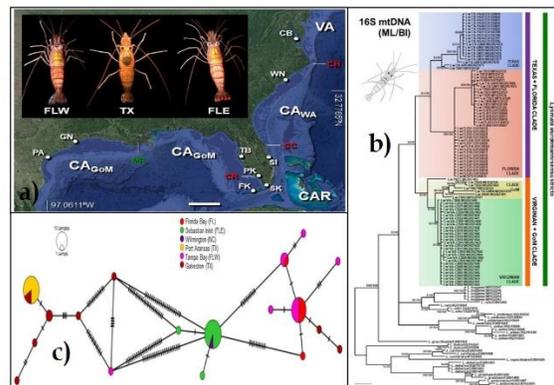
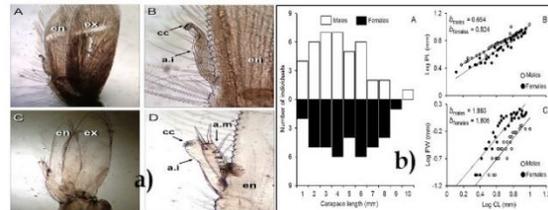


Fig. 1 a) Map showing the study area of *Lysmata wurdemanni* populations in the North Atlantic, Gul of Mexico and the Caribbean Sea; b) Molecular phylogeny (16S-ML) of *Lysmata wurdemanni* showing two major clades: 1. Texas + Florida clade, and 2. Virginia + Gulf of Mexico clade; and c) Haplotype Network analysis of *Lysmata wurdemanni* populations.

2. Reproductive physiology of coral reef dwelling caridean shrimps

Caridean shrimps exhibit astonishing diversity in terms of sexual systems. Many species are gonochoric, with populations comprising male and female individuals that never change sex. Various other species are strict protandry hermaphrodites, with individuals undergoing sex change from male to female with increases in size and/or age. Here, I focus on acquiring knowledge on the sexual and mating systems of coral reef dwelling caridean shrimps such as



‘peacock tail’ shrimp *Ancyllocaris brevicarpalis* and ‘hinge-beak’ shrimp *Rhynchocinetes durbanensis*, particularly, studying the primary and secondary sexual characters and mating behavior in the laboratory condition. The outcome of this research will help us to elucidate the fascinating evolutionary life history and gender expression in caridean shrimps.

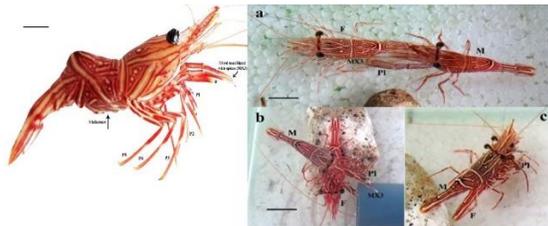


Fig. 2 a) Secondary sexual characters of *Ancyllocaris brevicarpalis* female (A, B) and male (C, D); and b) Size-frequency distribution of individuals (A) and relative growth of morphometric characters (B, C)

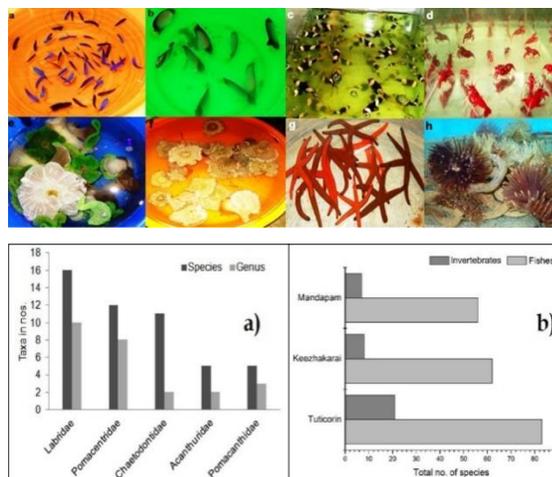
Fig. 3 Hinge-beak shrimp: *Rhynchocinetes durbanensis*. a, b, c shows the sequence of mating behavior

3. Status and exploitation of marine ornamental organisms in Gulf of Mannar, India

Marine aquarium trade is known to improve livelihoods of coastal communities who are entirely dependent on the collection and supply of coral reef ecosystem-associated taxa. However, the market/trade values of various species are known to vary significantly during the different phases of the supply chain, as it must pass through critical stages of quarantine,

maintenance, handling and shipping before reaching the hobbyists. For one year, almost species of fish (51% belonging to the family Pomacentridae) and 21 species of invertebrates were harvested for the trade. conservation status of exploited species revealed that nearly 50% (n=43) have not been assessed for their extinction risk by the IUCN, while of the 44 species assessed, 41 were Least Concern (LC), and one each was in the Data Deficient (DD), Near Threatened (NT) and Endangered (EN) categories. While many fish were collected, only a few were exported from India. The sea anemones were the major export as they were of a higher value in the international markets, largely attributed to their color patterns. Price discrepancies within the trade value of marine fishes and invertebrates used for the aquarium trade indicated that price increased approximately 200% at each transition in the value chain (collectors to wholesalers, wholesalers to retailers).

Gulf of Mannar being the major hotspot for the collection of coral reef organisms for aquarium trade from India, documentation of species diversity, population trend, harvest potential is a prerequisite for effective monitoring on export trends and endangered species management for sustainable trade in the country.



The

Fig. 4 Marine ornamental fishes and invertebrates ready for packing in the wholesalers' custody. a, blue damselfish *Pomacentrus caeruleus*; b) smoke angel *Apolemichthys xanthurus*; c) sebae clown *Amphiprion sebae*; d) blood shrimp *Lysmata debelius*; e) green carpet anemone *Stichodactyla haddoni*; f) carrot anemone *Phymanthus* sp.; g) finger star *Ophidiaster confertus*; h) sabellid worm *Sabellastarte spectabilis*

Fig. 5 a) Family wise (top 5) species diversity of marine ornamental fishes; b) Region wise species diversity of marine ornamental fishes and Invertebrates

4. Understanding the physiology and molecular adaptations of coral reef dwelling shrimps to climate change

Anthropogenic climate change alters many physical and chemical characteristics that comprise the niches of marine species and ecosystem habitats. Changes in these physicochemical conditions are already leading to shifts in the habitat ranges of some marine species (Cheung et al. 2009), and extinction rates of marine species are expected to increase (Pereira et al. 2010; Cahill et al. 2012). Increasing sea surface temperatures and lowering of pH are a major threat not only to the coral reef ecosystems but also to its associates which provide crucial services in maintaining the health and wealth of the reef systems. Therefore, the aim of this study primarily focuses on the understanding the impact of increasing temperature and ocean acidification on the natural life history adaptations of sea anemone symbiotic shrimp *Ancylocaris brevicarpalis*.

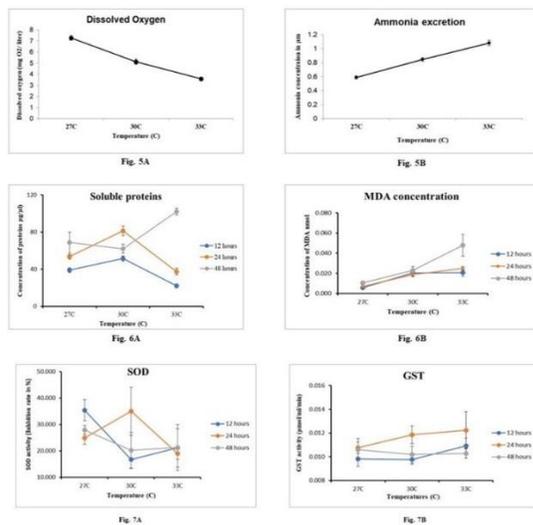


Fig. 6 Changes in biochemical parameters in *A. brevicarpalis* exposed to different temperature

References

1. Baeza, J. A. and Prakash, S, An integrative taxonomy and phylogenetic approach reveal a complex of cryptic species in the ‘peppermint’ shrimp *Lysmata wurdemanni sensu stricto.*, Zoological Journal of the Linnaen Society, 185(4) 2019 1018-1038.
2. Prakash et al., Marine aquarium trade in India: Challenges and opportunities for conservation and policy. Marine Policy, 77 (2017) 120-129.

Investigation of Responses of Marine Organisms with Respect to Prevailing Environmental Changes

Our research work includes understanding physiological and adaptive response of marine organisms to environmental changes such as ocean acidification and ocean warming. The

research also involves studying marine biodiversity using molecular approach taxonomy and systematic approach. The following are the major objectives of our research group.

1. Organismal response of seaweeds to climate change stressors and affect at community level.

In collaboration with Stazione Zoologica Anton Dohrn, Naples, Italy and researchers at Antwerpen University, Belgium, we are involved in understanding how brown algae *Sargassum vulgare* is thriving in the natural acidified vents off Ischia Island in the Mediterranean Sea. More recently, we have extended our studies on how biochemical changes in the algae due to climate change conditions may affect their ecological and economic services. In this regard, we have recently published an article entitled “Ocean acidification affects biological activities of Seaweeds: A case study of *S. vulgare* from Ischia volcanic CO₂ vents” in the journal Environmental Pollution. The main highlight of this work includes improved antimicrobial, antiprotozoal, antimutagenic potential, and anticancer activities in the algal extract growing at the acidified site (Fig. 1).

We have also initiated laboratory experiments to investigate tropical seaweed response, mainly *Chaetomorpha* sp. to elevated temperature and lowered pH conditions. We have also been performing no choice feeding assays to investigate feeding rate in amphipods as well as the influence of feed on growth, survival, and reproductive performance of amphipods.

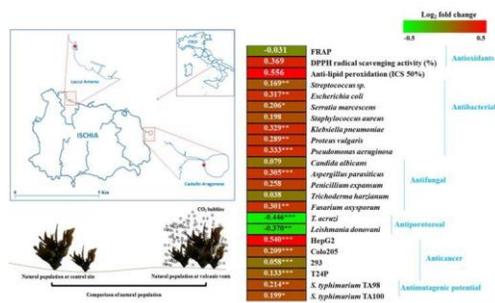
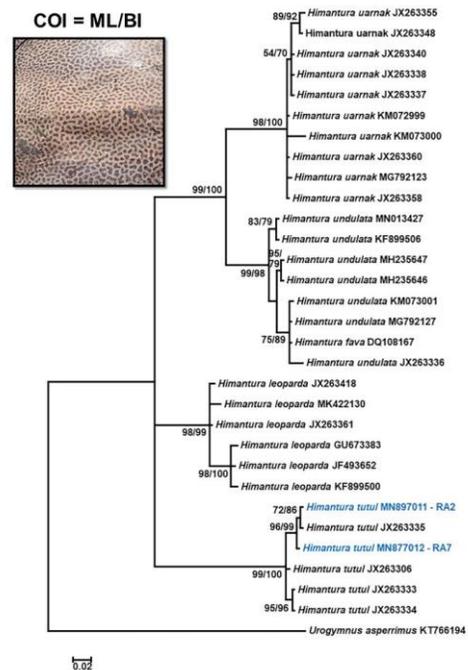


Fig. 1: Graphical abstract highlighting influence of natural acidification on the bioactivities of the brown algae *Sargassum vulgare*



2. Inventory, ecology and conservation of marine organisms

We have been making regular visits to the fish landing centre along Gulf of Mannar and Palk Bay as well as conducting underwater surveys in the Palk Bay to observe diversity in the marine organisms and species interactions. One of the recent findings in this regard is the first report of *Himantura tutul* from Indian waters based on DNA barcoding using COXI gene, published in the journal of Applied Ichthyology (Fig. 2). The genus *Himantura* belongs to order Myliobatiformes; Family Dasyatidae has 6 valid species and three of them are classified as “Vulnerable” in the IUCN Red list. Hence, understanding taxonomy, biology and fishery potential of *Himantura* spp. are important for conservation and management practices. We have been performing molecular phylogeny of order Myliobatiformes to ascertain their presence in Indian waters.

Fig 2: Maximum Likelihood phylogenetic tree of *Himantura tutul* based on mitochondrial COI gene sequence.

Microbial diversity of hypersaline environment and their biotechnological applications

We have been engaged in characterizing bacterial diversity thriving in the high saline conditions and whether these microbes can help us in solving environmental issues, e.g. bioremediation of metals, dye decolorization and degradation, radiation resistance/tolerance for sun-screen. We have recently published “Unveiling Cultivable and Uncultivable Halophilic Bacteria Inhabiting Marakkanam Saltpan, India and Their Potential for Biotechnological Applications” in the Geomicrobiology Journal. For the first time, we utilized third generation sequencer Oxford Nanopore MinIon sequencing to characterize uncultivable bacterial diversity. More recently, we have also identified 11 halophilic bacterial strains capable to tolerate/resist UV-B radiation. We are hopeful that these bacteria can be utilized as a microbial sunscreen for the protection against

UV radiations.

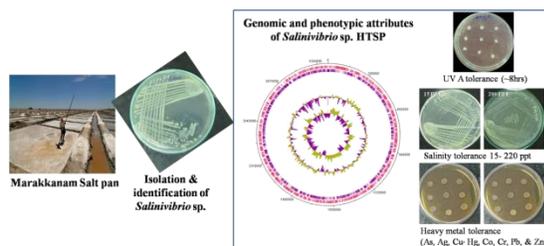
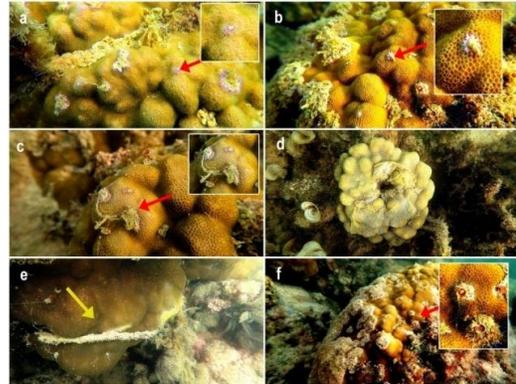


Fig 3: Isolation and characterization of halophilic bacterium *Salinivibrio kushneri* from Marakkanam saltpan.

13.3 Coastal Ecosystem Conservation

Coral Associates and Environmental Factors as Potential Stressors to the Corals at Olaikuda Reef, Palk Bay, Tamil Nadu

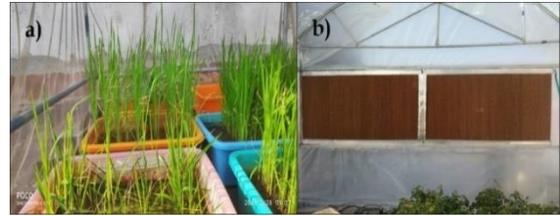
The objective of the work is to understand the coral associates as the stress inducing factors for the corals in the Olaikuda reef area, Palk Bay region, Tamil Nadu. The interaction of Polychaete tubeworm and Vermitid snail with *Porites* coral colonies at Olaikuda reef was documented. The Sea Surface Temperature (SST) can combine to have negative interactive effects, even when individual effects are not detectable.



Porites coral colonies at Olaikuda reef, Palk Bay region was observed with pink spot and covered with mucus. Close examination of these spots revealed the presence of Polychaete tubeworm and Vermitid snail. The polychaete worm made aberrant growth with pink spot and this would change the growth pattern or morphology of coral colonies. In addition to that, mucus produced by vermitid snail stressed the corals in the Palk Bay region by covering the corals with their sediment trapped mucus. This is the first report of coral associates stresses the coral colonies from Indian waters. These signs indicate the coral reef ecosystem in the Palk Bay region as under stress and if the situation is prolonged, there would be a phase shift in the Palk Bay reef ecosystem. This study also implies the need to improve our understanding of the biology and ecological role of vermetid gastropods, and the mechanisms and their interactions with corals.

Fig. 1 a) *Porites* colony with pink aberrant growth and conical Polychaete stout; b) tubedwelling vermetid snail; c) Mucus secreted by vermitid snail; d) The mucus of Vermitid snail covered the top position of a *Porites* colony. e) Mucus thread with sediment; and f) Stressed coral with algal assemblage and vermitid snail tubes.

The focus of the agricultural biotechnology lab, CCCS is on biotic and abiotic stress tolerance mechanism in plants. Our research objectives include i) Mechanism of rice resistance to plant- and leafhoppers (Rice phloem-plant hopper assemblage interaction; ii) Cross talk in defence signalling mechanism of rice plants to biotic and abiotic stress factors and iii) Insect adaptation mechanism to resistant host plants and insecticides. With these objectives, we have been working on different aspects of stress tolerance mechanism in plants with special reference to rice. In January 2019, a polyhouse structure with cooling pad facility was inaugurated by our honorable Chancellor Dr. Maria Zeena Johnson for studying insect-plant interactions.



In addition, we studied plant- and leafhopper resistance in rice differentials collected from South Asia and South East Asian countries. The research work was the collaborative efforts of scientists from reputed Institutes and Universities around the world. The study made a clear statement that rice differentials that were tolerant or resistant to plant- and leafhoppers have a higher degree of genetic similarity among themselves indicating a common lineage of resistance. The results of the study have been published in *Agronomy* journal and have provided lights in improving strategies for the breeding and deployment of resistant rice varieties in Asia. As part of the insect adaptation mechanism objective, we studied the gut microflora of rice green leafhopper (*Nephotettix virescens*) on different host plants with the hypothesis that shift in host plant changes the gut microbial diversity and community structure of leafhoppers. The study was the first to report the gut microbial diversity of rice green leafhopper and was able to reveal that host plant influences the gut microflora of hoppers. The study was conducted at the International Rice Research Institute, Philippines whereas the data curation and analysis were done at Sathyabama Institute and the study was published in *Ecology and Evolution* journal.

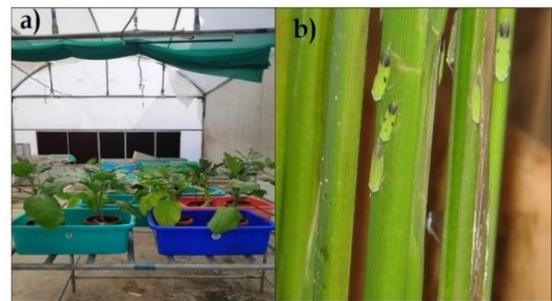


Fig. 1 a) Rice differentials maintained at the polyhouse and b) Cooling pad structure of the polyhouse

Fig. 2 a) Overview of the polyhouse and b) Rice green leafhopper feeding on rice

13.4 TEACHING AND LEARNING

We are committed to provide a high-quality education that enables our students to engage with sustainability challenges and to create indigenous solutions to the burning issues of climate change at the local, national and international levels. In support of this, we will encourage organizational training inviting subject experts from different university/institutions towards sustainability-oriented change.

In addition, CCCS join hands with the Centre for Professional and Career Development at Sathyabama to provide curriculum innovation, research-led practice and staff training.

1. UG – Environmental Science and Engineering – SBTA1001
2. Certificate course in Marine Biology and Climate Change
3. Field course in Intertidal Ecology and Climate Change
4. Practical course in DNA Taxonomy and Phylogeny



13.5 RESEARCH FUNDING

We are always grateful to your funding agencies who believe in our high-quality, cutting-edge research in the themes of marine ecology and climate change that embraces the real-world challenges to advance and translate knowledge and to drive innovation and enterprise. We are delivering research that helps to lead global change, providing evidence to underpin policy making and shape the way organizations operate, creating jobs and opportunity.

S. No.	Project title	Principal Investigator	Funding agency	Total fund (Rs.)	Duration & Status
1.	Status and safe exploitation of marine ornamental fishes and invertebrates from Gulf of Mannar, Tamil Nadu: An expensive reserve for conservation	Dr. S. Prakash	Rufford Foundation, London	5,02,400	2014-2015 (Completed)
2.	Physiology and molecular adaptations of coral reef dwelling caridean shrimps to climate change	Dr. S. Prakash	DST-SERB	21,82,000	2016-2019 (Completed)
3.	Evaluating the population structure and conservation status of endangered humphead wrasse <i>Cheilinus undulatus</i> in Gulf of Mannar	Dr. S. Prakash	Wildlife Conservation Trust (WCT), Mumbai	4,87,800	2018-2019 (Completed)
4.	Systematics of coral reef caridean shrimps of Gulf of Mannar	Dr. S. Prakash	The Linnaen Society, UK	90,232	2018-2019 (Completed)
5.	Studies on the interaction mechanism between resistant rice varieties and planthopper assemblages mediated through the phloem	Dr. Thanga Suja Srinivasan	DST-SERB (ECR)	38,55,731	2018-2021 (Ongoing)
6.	Can Seaweed contribute towards sustainable future by playing a role in climate change mitigation and adaptation?	Dr. Amit Kumar	DST-SERB (ECR)	29,55,000	2018-2021 (Ongoing)

13.6 PUBLICATIONS

1. Horgan F, Srinivasn T S, Crisol Martinez E, Almazan M L, Ramal A, Oliva R, Quibod I, Bernal C, Microbiome responses during virulence adaptation by a phloem-feeding insect to resistant near-isogenic rice lines. *Ecology and Evolution*, 9 (20) (2019) 11911 – 11929.
2. Prakash S, Ajith Kumar T T, K K. Lal, Infestation of bopyrid isopod parasite (Bopyridae) on ‘coral banded boxing’ shrimp *Stenopus hispidus* Olivier, 1811 (Stenopodidae) in the Lakshadweep archipelago, *Current Science*, 117(8) (2019) 1271-1273.
3. Saleem Raja U K, Ebenezer V, Kumar A, Prakash S, Murugesan M, Mass mortality of fish and water quality assessment in the tropical Adyar estuary, South India. *Environmental Monitoring and Assessment*, 191 (2019) 512.
4. Baeza J A, Prakash S, An integrative taxonomy and phylogenetic approach reveals a complex of cryptic species in the ‘peppermint’ shrimp *Lysmata wurdemanni sensu stricto*, *Zoological Journal of the Linnaen Society*, 185(4) (2019) 1018-1038.
5. John J, Siva V, Richa K, Arya A, **Kumar A**, Life in High Salt Concentrations with Changing Environmental Conditions: Insights from Genomic and Phenotypic Analysis of *Salinivibrio* sp, *Microorganisms*, 7 (2019) 577.
6. Seham M. Hamed, Sherif H Hassan, SamySelim, **Kumar A**, Sameh M.H. Khalaf, Mohammed A.M. Wadaan, Wael N. Hozzein, Hamada Abd Elgawad, Physiological and biochemical responses to aluminum-induced oxidative stress in two cyanobacterial species, *Environmental Pollution*, 251 (2019) 961-969.
7. Arya A, **Kumar A**, Inconsistencies in Some Common Terms and Notations in Enzymology: Textbook Examples and Suggestions. *Biochemistry and Molecular Biology Education*, 47 (2019) 140-144.

13.7 BOOK/BOOK CHAPTER

1. Srinivasan ST, Kannan RR, Single cell type metabolomics for crop improvement. In: (ed. Barh D and Azevedo, VA) Single-Cell Omics Technological Advances and Applications, (Applications in Biomedicine and Agriculture), *Elsevier Academic Press*, Vol. 2, (2019) pp.315-335.
2. Arya A, Gangawar A, Kumar A, Biosensors in animal biotechnology. In Nanotechnology in modern animal biotechnology: concepts and applications (Maurya PK, Singh S. eds.), *Elsevier Science*, (2019) pp. 75-96.

13.8 LAUNCH of MERC and CMSP

The Centre for Climate Change Studies as Sathyabama has officially launched two new initiatives: (i) Marine Ecology Researcher’s Club (MERC) and (ii) Citizen Marine Science Program (CMSP). The MERC aims to develop a network of action-oriented researchers who are involved in marine ecology.

The CMSP is to create awareness among the students and researcher’s community to uncover the underwater paradise such as coral reefs that are disappearing due to climate change. Both the platforms allowed the different stakeholders to discuss possible ways to save coral reefs and associated resources for the future generations. Our initiatives were highlighted in the International Year of the Reef report in April 2019.



Sathyabama Institute of Science and Technology members at the launch of two new initiatives. Middle row-seated L.R.S. Prakash and Amit Kumar (Founders of MERC and CMSP). Organisers of IYOR 2018 and T. Sasiprabha (Pro vice-chancellor). Photo credit: Sarjjevi Prasad

The Centre for Climate Change Studies at SIST has officially launched two new initiatives: (i) the Marine Ecology Researchers’ Club (MERC) and (ii) the Citizen Marine Science Program (CMSP). The aim of MERC and CMSP is to develop a network of action-oriented researchers who are involved in marine ecology and citizen science research in India. Following the announcement of the creation of these two initiatives there was a screening of Chasing coral. The idea of streaming the documentary was to create awareness among the students and researchers’ community and to uncover the underwater paradise showing that coral reefs are disappearing due to global climate change and to discuss the possible ways to save corals and their associated bioresources for the future generation. There were 130 participants.

13.9 SATHYABAMA MARINE RESEARCH STATION

Sathyabama Marine Research Station was established in the year 2019 to encourage our researchers to do cutting-edge marine ecology and climate change research to sustainably use, manage and conserve the natural ecosystems for the benefit of the coastal communities of Gulf of Mannar and Palk Bay regions.



The facilities at the marine station include SCUBA diving kits, microscope, underwater camera, plankton nets, PAM fluorometer etc. Marine Station would encourage our



researchers to do cutting-edge marine ecology and climate change research. The facilities will be used to manage and conserve the natural ecosystems sustainably for the benefit of the coastal communities of Gulf of Mannar and Palk Bay regions.

13.10 OUTREACH PROGRAMME

We are actively engaged in imparting skills through various lectures and hands-on- training sessions and promoting citizens to involve in coastal conservation.

1. Dr. Amit Kumar “Role of microbes in Environmental Restoration” KMMRC college, Chennai **19th January 2019.**
1. Dr. S. Prakash presented my paper at “The Crustacean Society – Mid Year Meeting 2019” at the Chinese University of Hong Kong, Hong Kong between **May 25 to May 29, 2019.**
2. Dr. D. Adhavan “Ecology and ecosystem services with reference to Climate change” organized by Tamil Nadu Science Forum, North Chennai at Madhavaram Girls High School, Perambur on **21st August 2019.**
3. Dr. S. Prakash “Future of coral reefs under rapid global climate change” at Nadar Saraswati College of Arts and Science, Theni on **27th August 2019.**
4. Dr. Adhavan, oral presentation “Seagrass restoration at Gulf of Kutch” at Rufford Foundation Annual meeting, Andaman and Nicobar Islands, **15 to 18 November 2019.**

13.11 MoUs

1. With Amazing Biotech Pvt. Ltd, Marakkanam, Villipuram District, Tamil Nadu.

SDG 14 - LIFE BELOW WATER



Oceans cover more than 70% of the planet and are a source of food and income for more than 10% of the world's population. Pollution and climate change continue to have a major impact on the ocean. Countries are working together to protect the marine environment from their effects and achieve United Nations Sustainable Development Goal (SDG) 14, which calls for conserving and sustainably using the oceans, seas and marine resources for sustainable development.

Sathyabama Institute of Science and Technology is focusing to conserve and sustainably use the oceans, seas and marine resources for sustainable development (SDG 14) through its premier research centres like Centre for Ocean Research, Centre for Climate Change Studies, Centre for Remote Sensing and Geoinformatics and Centre for Earth and Atmospheric Sciences. Centre for Ocean Research (COR) was established in 2007 as a joint initiative of National Institute of Ocean Technology (NIOT) Chennai and Sathyabama Institute of Science and Technology to encourage targeted sectors like reduce marine pollution; protect and restore ecosystems; reduce ocean acidification; sustainable fishing; conserve coastal and marine areas; end subsidies contributing to overfishing; increase the economic benefits from sustainable use of marine resources; increase scientific knowledge; research and technology for ocean health; support small scale fishers; and implement and enforce international sea law. The main role of the research centres are to facilitate a platform to the student communities from the Schools and Departments to utilize the high end instrumentation related to ocean science and research as Ocean education is enhanced through scientific cooperation and knowledge at all levels, through the development of research capacity and through the transfer of marine technology.

14.1. REDUCE MARINE POLLUTION

(By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution)

As eutrophication, nutrient run off to the ocean and plastic accumulation are the major problem indicated in 14.1, a collaborative work has been carried out with National Institute of Ocean Technology (NIOT) to study the growth response of the diatom *Chaetoceros* species to the elemental ratios of Deep Ocean waters. As ocean thermal energy conversion project in Indian Ocean is plan to utilize the Deep Ocean Water as one of the resources, the non-utilized Deep Ocean Water with high nutrient content could be used for raising micro algal culture for aquaculture and other marine bio prospecting applications. The sustainable output of the work was published in *Estuarine, Coastal and Shelf Science* (<https://doi.org/10.1016/j.ecss.2020.106812>).

To address the heavy metal pollution in estuary environment as the target 14.1 a collaborative study was carried out with P.G. and Research Department of Zoology, Jamal Mohamed College (Autonomous), Tiruchirappalli, Tamil Nadu, 620020, India. Mass mortality of fishes was reported at the Adyar estuary, South India, during November 2017. The probable reasons for fish mortality are analyzed in this paper. Critical assessments on water quality parameters including the metal concentrations, nutrients, and histology of gills and liver of fish (*Mugil cephalus*) isolated from the impact zone were performed. Among the metals observed, chromium showed levels ($3.64 \pm 0.001 \text{ mg L}^{-1}$) much above the average permissible limits (0.1 mg L^{-1}). The low salinity could have escalated the toxicity of the metal. In addition, histology of gills and liver showed cellular necrosis, epithelial lifting, hyperplasia, edema, mucous cell proliferation in the gills, cytoplasmic vacuolation of hepatocytes, and degeneration of liver which reveal that chromium toxicity is the most probable cause for mass mortality. The output was reported as publication in the journal *Environmental Monitoring and Assessment* (<https://doi.org/10.1007/s10661-019-7636-4>)

As per the SDG Target 14.1 Centre for Ocean Research and Department of Visual Communication, Sathyabama Institute of Science and Technology jointly organized a “National Workshop on the Awareness of Marine Plastic Debris in Indian Seas (Pollution & Solution) —

WAMP2020” in partnership with International Union for Conservation of Nature (Commission on Ecosystem Management & Commission on Education and Communication) on 22nd& 23rd January 2020. The theme of the WAMP2020 was to create awareness on the impact of plastic litters and its alarming accumulation in our surrounding environment. ‘Mobile media’ is used as the tool to gather young minds. Abstracts are invited fore-posters, awareness videos & scientific cartoons from students, scholars, researchers, post docs, faculties and scientists for best presentation awards. The program highlights the objectives of Swachh Bharat Mission and Digital India Program as per the GOI norms.



References:

<https://harnessingnature.wordpress.com/2019/10/16/national-workshop-on-the-awareness-of-marine-plastic-debris-in-indian-seas-pollution-and-solution/>

<https://vigyanprasar.gov.in/wp-content/uploads/Vigyan-Samachar-MoES-News-1-24-Jan-20.pdf>

14.2. PROTECT AND RESTORE ECOSYSTEMS

(By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans)

A collaborative research was carried out between with National Institute of Ocean Technology and Indian Institute of Technology, Chennai towards the Target 14.2 through the assessment of wetland change dynamics of Chennai coast, Tamil Nadu, India using satellite remote sensing. The coastal wetlands of Chennai are increasingly being affected by anthropogenic factors, such as urbanization, residential, and industrial development. This study helps to monitor and map the dynamics of the coastal wetlands of Chennai using Landsat satellite images of 1988, 1996, 2006, and 2016 by following a supervised classification method. Post-classification wetland change detection was done in three temporal phases, that is, 1988 1996, 1996 2006, and 2006 2016. Change detection matrix analysis was performed to identify the form of changes. Ground truthing was carried out to validate the wetland classes. The overall accuracy of the classified image was 79.29% and the kappa coefficient was 0.7600. These results were imported into a GIS environment for further analysis. It was found that the wetlands have decreased to an alarming extent in the past 28 years from 23.14% in 1988 to 15.79% in 2016 of the total study area, owing to conversion of wetlands into industrial development, urban expansion, and other developmental activities. The sustainable output of the work was published in Indian Journal of Geo-Marine Sciences (IJMS) (<http://nopr.niscair.res.in/handle/123456789/49703>).

To address the ecosystem based solution for the protection of marine ecosystem, Sathyabama Institute of Science and Technology has contributed to the Learning Solutions from Nature on International Day for Biological Diversity, with IUCN Commission on Ecosystem Management South Asia. A small movement from Commission on Ecosystem Management to learn more from nature, go sustainable, on the celebration of Biodiversity day was documented as video and broadcasted in CEM_SA IUCN Youtube channel (https://youtu.be/JELjcIhMZ_M?t=766)

14.3. REDUCE OCEAN ACIDIFICATION

(Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels)

Aquaculture is one of dominating seafood production sector in India, which is facing the global climate challenges for the sustainable and progressive production. Aquaculture is majorly threatened by changes in temperature, salinity, ocean acidification and extreme climatic events that affect infrastructure and livelihoods which can impact aquaculture both negatively and positively. The role of environmental stress such as temperature fluctuations, salinity changes, low pH and low dissolved oxygen to stress the host and suppress its immune system have been recognized long back. As a consequence, the incidence of disease outbreaks and rates of pathogen transmission often increase during changes in the environment.

To address the Target 14.3, this research project is being carried out with the support of National Initiative on Climate Resilient Agriculture (NICRA), Indian Council of Agricultural Research. The impact of temperature anomalies on infectivity pattern of Vibriosis in *Litopenaeus vannamei* and to develop suitable dietary interventions (functional feed) to mitigate the disease outbreaks due to temperature anomalies stress has been addressed in this ICAR project (Ref. 2-13(8)/20-21/NICRA 30.04.2020).

Products developed in this ICAR project: Nano-based functional feed for mitigate the temperature stress and disease incidence.



Seaweed aquaculture, the fastest-growing component of global food production, offers a slate of opportunities to mitigate, and adapt to climate change. Seaweed farms release carbon that maybe buried in sediments or exported to the deep sea, therefore acting as a CO₂ sink. The crop can also be used, in total or in part, for biofuel production, with a potential CO₂ mitigation capacity, in

terms of avoided emissions from fossil fuels, of about 1,500 tons CO₂ km⁻² year⁻¹. Seaweed aquaculture can also help reduce the emissions from agriculture, by improving soil quality substituting synthetic fertilizer and when included in cattle feed, lowering methane emissions from cattle. Seaweed aquaculture contributes to climate change adaptation by damping wave energy and protecting shorelines, and by elevating pH and supplying oxygen to the waters, thereby locally reducing the effects of ocean acidification and de-oxygenation.

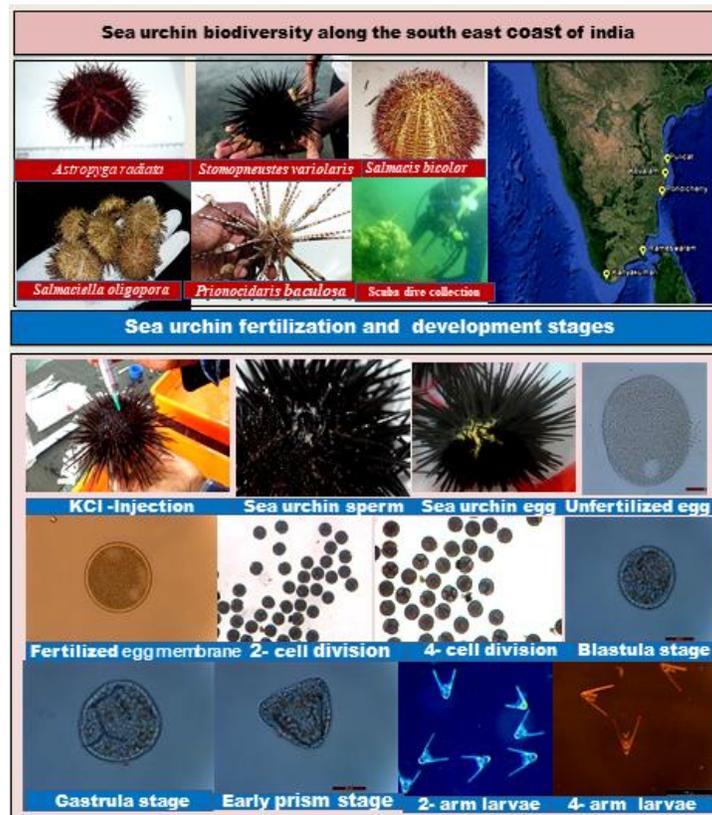
To address the Target 14.3, this research project is being carried out with the support of Science and Engineering Research Board, Department of Science and Technology. Contribution of Seaweed towards a sustainable future by playing a role in climate change mitigation and adaptation has been addressed in this SERB project (Ref: ECR/2017/002894)

A collaborative study was carried out with Center of Villa Dohrn Ischia – Benthic Ecology, Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, P.ta S. Pietro, Ischia, Naples, Italy, Department of Biology and Evolution of Marine Organisms, Stazione Zoologica Anton Dohrn, Villa Comunale, Naples, Italy, Department of Pharmacology and Toxicology, College of Pharmacy, King Saud University, Riyadh, 11451, Saudi Arabia, Bioproducts Research Chair, Zoology Department, College of Science, King Saud University, Saudi Arabia, Botany and Microbiology Department, Faculty of Science, Beni-Suef University, Beni-Suef, Egypt, Integrated Molecular Plant Physiology Research Group (IMPRES) Department of Biology, Belgium to report the impact of ocean acidification to support the Target 14.3. The study utilized volcanic CO₂ vents at Castello Aragonese off Ischia Island as a natural laboratory to investigate the effect of lowered pH/elevated CO₂ on the bioactivities of extracts from fleshy brown algae *Sargassum vulgare* C. Agardh. They analysed the carbohydrate levels, antioxidant capacity, antibacterial, antifungal, antiprotozoal, anticancer properties and antimutagenic potential of the algae growing at the acidified site (pH ~ 6.7) and those of algae growing at the nearby control site Lacco Ameno (pH~8.1). The results of the present study show that the levels of polysaccharides fucoidan and alginate were higher in the algal population at acidified site. In a snapshot they performed bioactivity assays but did not characterize the chemistry and source of presumptive bioactive compounds. Nevertheless, the observed improvement in the medicinal properties of *S. vulgare* in the acidified oceans provides a

promising basis for future marine drug discovery. The outcome of this work was published in Environmental Pollution journal (<https://doi.org/10.1016/j.envpol.2019.113765>)

14.4. SUSTAINABLE FISHING

(By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics)



Sea urchin gonads are considered a delicacy in many cultures, especially Japan, which is by far the largest consumer. About 9,000 tons of sea urchin gonads are consumed in Japan every year. Keeping this market demand on mind and to provide sustainable solution for echinoderm fishing, sea urchin aquaculture program is undertaken in collaboration with National Institute of Ocean Technology with the support of Ministry of Earth Sciences. A land-based grow-out of sea urchins, *Salmacis bicolor* species has been developed. The suitable output of the aquaculture program resulted on sea urchin brood stock conditioning, sea-cage nursery methods, diet and nutrition, and grow-out to market.

To address the overfishing, illegal, unreported and unregulated fishing in Target 14.4, a research project is being carried out with the support of Ministry of Earth Sciences. Land based closed cycle culture of Indigenous sea urchin species and development of post-harvest protocols for preservation of roes has been addressed in this MOES project (Ref: MoES/36/OOIS/Extra/39/2014)

14.5. CONSERVE COASTAL AND MARINE AREAS

(By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information)



As per the SDG* 1, 5, 13, and 14 Centre for Ocean Research, Sathyabama Institute of Science and Technology have initiated cultivation of red sea weed (*Kappaphycus alvarezii*), by imparting rigorous entrepreneurship trainings to fisherwomen in the field research station at Col. Dr. Jeppiaar Fishing Harbor, Kanyakumari Dt. Self-help groups were formed at Muttom fishing harbor vicinity in Tamil Nadu, making seaweed as an alternative source of income generation. On an average per capita, a woman generates Rs. 8000 by selling fresh seaweed. More than 100 trained fisher women are engaged in deploying about 500 rafts made out of bamboo and started harvesting about 15 tonnes of the *Kappaphycus alvarezii* seaweed once in 35 days from sea. This initiative is funded by Sathyabama Institute of Science and Technology, Chennai. This social relevance activity was highlighted by Harnessing Nature, the official blog of International

Union for Conservation of Nature - Commission on Ecosystem Management, South Asia. (<https://harnessingnature.wordpress.com/2019/02/24/creating-opportunities-for-women-through-seaweed-farming/>)

14.6. END SUBSIDIES CONTRIBUTING TO OVERFISHING

(By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation)

To enhance the public conservation awareness on illegal fishing as per the Target 14.4, Centre for Ocean Research, Sathyabama Institute of Science and Technology, has taken up the task of investigating the preliminary landing data, biological characteristics and diversity of elasmobranchs along the coast of Tamilnadu such as Chennai, Nagapattinam and Tuticorin. One problem that has been identified to disadvantage conservation efforts in this region is the lack of knowledge on endangered species among the fishermen populations engaged in fishing activity. Public awareness and involvement is critical to conserve sharks and rays in the coastal waters of Tamil Nadu. Thus, the Centre for Ocean Research is carrying out an awareness campaign since 2017 to till date for conservation of sharks and rays, with the support of Rufford foundation – where fishermen are the key agents of change. In this project, species identification flyers prepared in local language (Tamil) is circulated among fishermen, boat owners and other stakeholders to create awareness on the red listed species and their importance in the ecosystem. This social relevance activity was highlighted by Harnessing Nature, the official blog of International Union for Conservation of Nature - Commission on Ecosystem Management, South Asia. (https://www.iucn.org/sites/dev/files/content/documents/newsletter_eg_january_2019.pdf)

14.7. INCREASE SCIENTIFIC KNOWLEDGE, RESEARCH AND TECHNOLOGY FOR OCEAN HEALTH

(Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the

contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries)

The molecular taxonomic work underlying species discoveries lays the foundations for all subsequent biodiversity-based research. To know how many species exist provides valuable information about progress in the rate of discovery of life on Earth. Moreover, species richness the number of different species in an area is one of the key metrics for estimating species diversity, which is the basis for many comparative ecological, biogeographic and conservation studies. We are doing one of important marine conservation project from Ministry of Earth and Science (MoES) entitled “Characterization and DNA barcoding of polychaetes from the South East Coast, India” Project No. MoES/36/OOIS/Extra/53/2016, Dated: 09/07/2019.

In details, polychaetes represent a well-defined community among the total macrofaunal groups in most marine environment in terms of numbers and individuals. Distribution of polychaete species is mainly linked to the sediment particle size in which they are residing and constitute the largest faunal assemblage on earth and the biomass in these sediments. To date, traditional taxonomy relies mostly on diagnostic morphological characters, In this regard, DNA barcoding has proved to be a useful alternative method for rapid global biodiversity assessment, providing an accurate identification system for living organisms

Generation of Induced Pluripotent Stem Cells from Endangered/Threatened/Vulnerable Fish Species for Ex-Situ Conservation

Always humankind has viewed the ocean as an infinite resource for food. Its vast size and depth and unexplored frontiers made the ocean appear invulnerable to over exploitation. But the truth is that the populations of many species are decreasing at an unsustainable rate, and the number of species listed as endangered from marine life families like whales, dolphins, salmon and sharks are on the rise and as such the conservation of these species is an immediate priority. The research team at Centre for Ocean Research is working to conserve these species by using the generation of induced pluripotent stem cells (iPSC) technology, i.e. to preserve genetic material of these species. iPSCs are generated from somatic cells by direct reprogramming using Yamanaka factors or using small compounds and they are capable of unlimited

expansion and differentiation into multiple cell types. Previously iPSC technology has been successfully implemented in endangered species of mammals like Prairie voles (*Microtus ochrogaster*), Rhesus macaque (*Macaca mulatta*), Drill (*Mandrillus leucophaeus*), Snow leopard (*Panthera uncia*) and Northern white rhinoceros (*Ceratotherium simum cottoni*) and provided a novel approach in conservation biology. So far this approach has been dealt only with mammalian systems and none has reported the use of iPSC technology for conservation in India.

The possibility of producing iPS cells from endangered/threatened/vulnerable fish species will provide an infinite source of undifferentiated stem cells, as iPSCs are immortal and can be continually expanded and easily frozen, which can be differentiated into sperm or oocytes that can be banked and thus act as a promising tool for preserving genetic material and also protecting the species from extinction.

Fish Embryonic Stem (ES) Cells for the Production of Transgenic Fish

The research team at Centre for Ocean Research is also working on Fish Embryonic Stem (ES) Cells to produce transgenic fish for aquaculture and for generation of surrogate breeders for species with reproduction problems. Embryonic stem cells (ES) are unique cell populations derived from early embryos with the ability to undergo both self-renewal and differentiation. Upon transplantation into early embryos they can differentiate into various cell lineages including cells of the germ line and can be propagated in unlimited quantity for clinical applications. ES cells are also a promising tool towards the generation of transgenic animals. When ES cells colonize germ cells in chimeras, transgenic animals with customized phenotypes are produced and used for functional genomics studies. While until recently ES cell approaches have been mostly limited to mammalian systems, but there has been a growing interest to develop ES cells from fish for research purposes (e.g., to produce transgenic fish for aquaculture and for generation of surrogate breeders for species with reproduction problems). The research team at Centre for Ocean Research has successfully concluded the project on developing embryonic stem (ES) cells from Zebrafish for transgenic applications during the year 2019.

Supporting documents:

Development and characterization of a skin cell line (SGA) from the Mosquito fish, *Gambusia affinis* and its susceptibility to fish Betanodavirus (<https://doi.org/10.1016/j.aquaculture.2019.734778>)

Isolation, culture and differentiation of blastema cells from the regenerating caudal fin of zebrafish (<https://doi.org/10.3390/fishes5010006>)

Cells isolated from regenerating caudal fin of Sparus aurata can differentiate into distinct bone cell lineages (<https://doi.org/10.1007/s10126-019-09937-3>)

EARTH SCIENCE AND TECHNOLOGY CELL (Marine biotechnological studies) has been established at Col. Dr.Jeppiaar Research Park, Centre for Ocean research supported by MINISTRY OF EARTH SCIENCES (MoES), and Government of India.



The aim of the MoES-ESTC is to promote research and development towards the SDG 14 targets such as reduce marine pollution; protect and restore ecosystems; reduce ocean acidification; sustainable fishing; conserve coastal and marine areas; end subsidies contributing to overfishing; increase the economic benefits from sustainable use of marine resources; increase scientific knowledge; research and technology for ocean health; support small scale fishers; and implement and enforce international sea law.

The objectives of the MoES-ESTC at Sathyabama Institute of Science and Technology is also in agreement with the sustainable develop goals, such as to augment marine living resources and marine biotechnology in collaboration with CMLRE and NIOT; to identify the R&D requirements and to fulfil the gap to develop potent marine bioactive products; to establish collaboration between National and International Institutions; and to create infrastructure facilities related to advanced research in marine biotechnological studies. (Ref: MoES/11-MRDFIESTC-MEB(SU)/2/2014 PC-III) <https://www.moes.gov.in/content/research-projects-2>
<https://twitter.com/gopiye/status/1050596989816070145?lang=en>

Healthy oceans and seas are essential to our existence. They cover 70 % of our planet and we rely on them for food, energy and water. Yet, we have managed to do tremendous damage to these precious resources. We must protect them by eliminating pollution and overfishing and immediately start to responsibly manage and protect all marine life around the world. The world's oceans drive global systems that make the Earth habitable for humankind. The sea regulates everything from rainwater, weather and climate to our food and the air we breathe. The first method of travel between continents, the ocean continues to be used in travel and transportation today.

We need to carefully manage this essential global resource in order to achieve a sustainable future. Despite this, there is a continuous deterioration of coastal waters due to pollution and ocean acidification, which is directly impacting marine ecosystems, biodiversity and even small-scale aquaculture operations. The fragility of the world's oceans is strongly connected to global socio-economic issues, and can contribute to health, safety and financial risks.

LIFE OF LAND (SDG 15)



In 2015 the United Nations adopted 17 interconnected Sustainable Development Goals (SDGs) addressing the global challenges of poverty, inequality, climate change, environmental degradation, prosperity, peace, and justice. The goals are to be achieved by 2030.

The 15th Sustainable Development Goal is to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. It has 12 specified targets related to how to preserve and sustainably use the Earth's terrestrial species and ecosystems.

Centre for remote sensing and Geoinformatics of Sathyabama Institute of Science and Technology has taken significant steps for achieving these targets. We have undertaken a major research project sponsored by Council for Scientific and Industrial Research (CSIR), India focussing on developing flash flood monitoring (Project reference number, 23(0034)/19/EMR II). Flash flooding is responsible for heavy loss and degradation of land and environment. This research project contributes a lot towards SDG 15.1 (CONSERVATION AND RESTORATION OF TERRESTRIAL AND FRESHWATER ECOSYSTEMS). Lakes are considered as the great sources of fresh water. We have conducted resistivity surveys for storage assessment of lake water. Few field pictures are provided below:



Anthropogenic disasters (floods and droughts) affect the fresh water ecosystems. We have conducted a national conference on “Recent Advances in Anthropogenic Disaster Monitoring (RAADM 2019). This conference was sponsored by Ministry of Earth Sciences and aimed at exchanging ideas on disaster monitoring and fresh water ecosystems (LINK IN FACEBOOK page of Sathyabama: <https://www.facebook.com/SathyabamaOfficial/posts/2707195592634452>). Students learnt a lot about techniques to monitor floods, droughts and cloud bursts. This conference also aids at addressing SDG 15.1.

We are engaged in research focussing on exploring land use and land cover changes using remote sensing and GIS. We have explored changes in Land Use and Land Cover (LULC) over Baramulla district of Kashmir using remote sensing and Geographic Information System (GIS). This work examined the impact of changes in forest cover on Ecology and economy of the study area. Result reported in this study highlighted the importance of restoration of forest areas (Meer, Mohammad Suhail, and Anoop Kumar Mishra. "Land Use/Land Cover Changes over a District in Northern India using Remote Sensing and GIS and their Impact on Society and Environment." *Journal of the Geological Society of India* 95, no. 2: 179-182.). This significant work contributes to SDG 15.2 (END DEFORESTATION AND RESTORE DEGRADED FORESTS)

For increasing the productivity of the underutilized land, groundwater availability and quality was explored for a case study in Thiruvannamalai. The outcome of the study was validated in Vengikal village and this work was funded by Department of Science and Technology. This important research contributes towards to SDG 15.3 (END DESERTIFICATION AND RESTORE DEGRADED LAND). This research work yielded few quality publications (Santhanam, K., Abraham, M. and Mishra, A.K.. Productivity Improvement of Wasteland in Drought-Prone, Overdrafted and Rocky Terrain Watershed: A Case Study of Upper Thuringal Watershed in Ponnaiyar Basin Tamil Nadu, India. *National Academy Science Letters*, pp.1-4.). Remote sensing techniques present an advanced tool for improved monitoring of biodiversity and natural habitats. We have conducted a two days national seminar funded by Indian Space Research Organization on “Emerging trends in Satellite Technology and applications”. Various techniques to monitor biodiversity and natural habits were discussed in the conference and

students learnt a lot about these tools. Sustainable Development Goal 15.5 (PROTECTION OF BIODIVERSITY AND NATURAL HABITATS) was addressed during this conference. A picture showing Dr. P.Nila Rekha, Principal Scientist, Central Institute of Brackish water Aquaculture(CIBA)/ICAR, Chennai delivering a talk during this seminar:



Facebook link of this conference can be accessed at <https://www.facebook.com/SathyabamaOfficial/posts/2326412590712756>.

We have devised a unique technique by integrating methods combining the information obtained by geo-hydrological field mapping and those obtained by analysing multi-source remotely sensed data in a GIS environment for better understanding the Groundwater condition in hard rock terrain. This work contributes very significantly towards conservation of mountain ecosystems. Thus, this work adds to partial accomplishment of 15.4 (ENSURE CONSERVATION OF MOUNTAIN ECOSYSTEMS). Research finding has been published in (Mohana, P. and Muthusamy, S., 2019. Use of Earth Observation Images and GIS Techniques for Groundwater Exploration in Hard Rock Terrain. *Journal of Geography and Cartography*, 2(1).)

We also have devised techniques for exploring near real time flash flooding using satellite observations. Flash flooding is serious contributor to land degradation. Accurate assessment and forecasting of these events are very essential for mitigation of land degradation. Thus, this significant work is very crucial for the accomplishing the goal 15.3 (END DESERTIFICATION AND RESTORE DEGRADED LAND). Results were published in three high impact journals with following details:

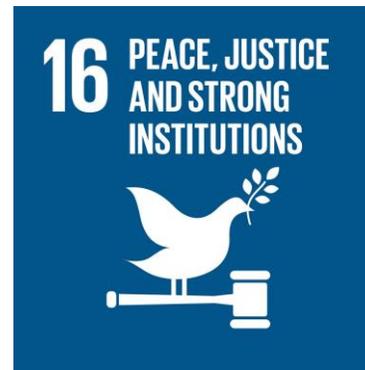
Anoop Kumar Mishra, Mohammad Suhail Meer and V. Nagaraju (2019), "Satellite based monitoring of recent heavy flooding over north-eastern states of India in July 2019", *Natural Hazards*, 97(2), 1407-1412. Doi. 10.1007/s11069-019-03707-z, impact factor: 2.319, July 2019

Anoop Kumar Mishra (2019), " Improving precipitation estimates over orographic regions by integrating multi-spectral satellite observations with rain gauge in India", *Remote sensing Applications: Society and Environment*, vol 15, Doi: 10.1016/j.rsase.2019.100252, impact factor: 1.019 February 2019

Anoop Kumar Mishra and N. A. Nagaraju (2019), " Space-based monitoring of severe flooding of a southern state in India during south-west monsoon season of 2018", *Natural Hazards*, vol 97 (2), 949-953, doi. 10.1007/s11069-019-03673-6, impact factor: 2.319 July 2019

We only have one planet, and we are proud to be working hard to protect it. We are committed to use it responsibly now, and conserve it for the future and for the betterment of our next generation.

SDG 16: Peace, Justice and Strong Institutions



Conflict, insecurity, weak institutions and limited access to justice remain a great threat to sustainable development. Goal 16 is dedicated to the promotion of peaceful and inclusive societies for sustainable development, the provision of access to justice for all, and building accountable institutions at all levels. National and global institutions have to be more transparent and effective, including local governance and judicial systems which are critical to the guarantee of human rights, law and order, and security.

Application of sustainability principles is of paramount importance and teaching SDG-16 related issues is the most direct way to contribute towards implementation, Sathyabama Institute of Science and Technology (Deemed to be University) at the front line in terms of contributing to the generation of sustainable practices, improving the ways sustainability is perceived, taught, modeled, and implemented. Towards this end Sathyabama **included** proper education and training, involve new ways of doing research, and promoting an authentic engagement with the community. Education for sustainable development (ESD) plays a central role in



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our unavoidable commitment to build a sustainable future for the good of our society and the planet. One of the key areas of is the reorientation of the curriculum towards sustainability. Sathyabama implement changes in areas such as leadership; management; research; and, mainly, in the training of teachers.

16.1 Access to Justice:

SDG16 to reflect that creating peaceful, just and inclusive societies requires simultaneous efforts in other interlinked SDGs. Justice is a thread that runs through all 17 Sustainable Development Goals (SDGs). SDG16.3 promises to ensure equal access to justice for all by 2030. Without increased justice,



the world will not be able to end poverty, reduce inequality, reach the furthest behind first, create conditions for shared and sustainable poverty, or promote peace and inclusion. Importance of Alternative Dispute Resolution is one such measure that can help and training of trainers is an initiative towards the change.

End abuse, exploitation, trafficking and all forms of violence against and torture of children. The center for Human Rights offers a great opportunity for the successful implementation of the SDG 16. The centre functions with a people-centered approach to justice starts with an understanding of people's justice needs and designs solutions to respond to them.

To significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime- Awareness programs conducted on organized crime.





Promote and enforce non-discriminatory laws and policies for sustainable development.

Partnerships between Academia, Civil Society and Private Sector The complex nature of the SDGs requires innovative partnerships involving academia, civil society and the private sector, because no sector has the singular financial, human and technical capacity to address all of them effectively. The private sector and civil society may come up with capacity building programmes in areas of sustainable development. There are three main approaches being used by Sathyabama when implementing sustainability and ESD: the individual approach (tackled by individual academics); the sectorial approach (a department); and the institutional approach, where the whole university is committed to sustainability. The implementation is a top-down process. The integration of sustainability maintains degree structures and focus on working through disciplines and subjects and through an interdisciplinary approach.

Sathyabama Create institutional guidelines for sustainability by promoting academic engagement and training in sustainability that leads to curriculum reorientation and innovation , develops approaches for the integration of teaching, research, management, and community engagement that is essential for curriculum reorientation that subjects are designed with a focus on ESD by introducing its concepts, content, values, competences, and teaching methodologies. This implies learning to act ethically, to clarify one's own values, and to ask critical questions, Students actively participate and work with others in interdisciplinary and trans disciplinary teams to achieve sustainable development Goal 16. This competence enabled the faculty and students to participate in discussions and intercultural dialogues, as well as to collaborate with



other stakeholders in the design and implementation of actions and policies that can transform reality. Transformative teaching and learning methodologies such as the co-creation of emerging futures is implemented and this methodology is based on the idea of doing actions in the present that contribute to the future having the potential to be as

we want it to be.



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National Conference on Sustainable Development - 6th February, 2019. School of Law has organized one day National Conference on Sustainable Development. Honourable Mr. Justice S. Rajeswaran the Chief Guest has delivered the inaugural address and released the Conference Proceedings published in an

international Journal with impact factor.



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Further, Goal 16 includes the need for capable, participatory political institutions designed to reduce political, social, and economic inequality. Leaving no one behind is also a core principle of the 2030 Agenda to which member states have committed. One path to achieving this is through strong and inclusive political institutions, which respect values enshrined in the Universal Declaration of Human Rights (UDHR) and the subsequent human rights instruments developed by the international community. These universal values set the stage for people to claim their rights on political, social, and economic fronts.



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Tamil Nadu State Commission for Women Chairperson Tmt.Kannagi Packianathan IAS addressing the students and local community

Targets (a) and (b) of Goal 16 are also direct applications of human rights principles within the development framework. SDG 16(a) calls for strengthening “relevant national institutions, including through international cooperation, for building capacity at all levels, in particular developing countries, to prevent violence and combat terrorism and crime.

Further, SDG 16(b) calls for the promotion and enforcement of non-discriminatory laws and policies. Non-discrimination is enshrined in Article 7 of the UDHR, and extends its application to realizing peaceful, just, and inclusive societies. There is presently no data readily available on whether states are making progress toward SDG 16(b).

National Conference on Cyber Space and Cyber Laws-16th November 2018.

As Cyber laws encompasses everything that pertains to protecting our sensitive data and personally identifiable information, intellectual property, data and information from theft and attempt to damage by criminals. Therefore this Conference was attempted to impart Cyber laws.





School of Law, Sathyabama Institute of Science and Technology **Inaugurated Anti Human Trafficking Club on 17th September 2019.** Mrs. Sharmu Rajan , Deputy Superintendent of Police, Kancheepuram District delivered the inaugural address.

School of Law, Sathyabama Institute of Science and Technology organized **One day National Workshop on 24th January 2020 on "Investigation and Trail Process in Indian Judicial System"**. Thiru.V.Vinoth Santharam, Assistant Commissioner of Police, Adyar delivered the inaugural address.

In reorienting their subjects' curricula in order to contribute to the sustainable development goals. UNIVERSITY held the Sustainable Development Goals Leadership Workshop. The Workshop brought together leadership from across the University to align and map delivery of Sathyabama's commitment to the SDGs with its Strategic Intent and to identify opportunities across research, learning, teaching, operations, governance and culture.



outcomes emerged from the Workshop:

Increased awareness of Sathyabama Institute of Science and Technology commitment to the SDGs among the University leadership including senior and middle management. An understanding of how the SDGs can be used as a planning and operating framework across the

University, Scoping of opportunities for aligning the SDGs with activities in operations, research, curricula and stakeholder engagement. There are future plans to build on the interest across the University in the SDGs by extending this workshop model to the student body and to all staff. Outcomes are already in evidence in the University's planning work, as themes that emerged from the Workshop are being fed into the University's strategic planning processes.



SathyabamaOfficial



GOAL 17: PARTNERSHIPS FOR THE GOALS

Stronger partnerships are very essential for sustainable development to mobilize resources, share knowledge and technologies and gain synergistic advantage. Sathyabama Institute of Science and Technology strives to promote partnerships and collaborative agreements with national and international organisations and Universities that facilitate the achievement of sustainable development.

Sathyabama is well connected both at national and international level. It is involved in the collaborative activities such as Joint Academic Programmes and Joint research Programmes with partners across the world. The collaboration has resulted in knowledge sharing with academicians, scientists and researchers across the world. The Collaborations keeps the research and development efforts of our Institution on par with the research and development happening throughout the world. We are able to set targets, goals and benchmarks for us when we work with international counterparts, so that we are sure that we don't lag behind anyone in terms of quality education, research and innovation.

We work in coordination with many Government organisations, Government Agencies, local administrative bodies and Non-Governmental organisations to enhance, support and achieve the sustainable development goals.

17.1 Research Collaborators at National level

The Institution is involved in various sponsored and collaborative R&D projects funded by National Organizations like

- Indian Space Research Organization (ISRO)
- Department of Science and Technology (DST)

- Department of Bio Technology (DBT)
- Indira Gandhi Centre for Atomic Research (IGCAR)
- Defence Research and Development Organization (DRDO)
- Board of Research in Fusion Science and Technology (BRFST)
- Combat Vehicles Research and Development Establishment (CVRDE)
- Central Leather Research Institute (CLRI)
- Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI)
- All India Council for Technical Education (AICTE)
- Indian Space Research Organization (ISRO)
- Indian council for Medical Research (ICMR).

Many of our research projects are sponsored by various Ministries like

- Ministry of Human Resource Development (MHRD),
- Ministry of Earth Sciences (MoES) and
- Ministry of Environment and Forests (MoEF).

Our researchers have also collaborated with the Universities across India for doing joint research and made joint publications with the faculty working in other Indian Universities.

17.2 Internationalization at Sathyabama

Over the past 10 years India has become an increasingly attractive study destination for students across the globe. To cater to the growing demands of Internationalization of education, Indian Universities are undergoing transformation transcending National boundaries.

With its admirable academic ambience and excellent research facilities, Sathyabama Institute of Science and Technology has all the features of a world class University that has the potential to become an attractive destination for Higher Education to the students across the Globe.

17.3 Centre for Academic Partnership and International Relations

Sathyabama Institute of Science and Technology has a devoted Centre, Known as Centre for Academic partnership and International Relations that establishes international linkages and

alliances to promote collaborative activities. The Centre has been instrumental in the establishment of international tie ups and has initiated collaborations with International Universities and Research Organisations across the globe. The Centre coordinates all the International Programmes.

17.4 International Alliances and Collaboration

Sathyabama Institute of Science & Technology has alliances with leading Universities and research establishments across the globe. We have more than 150 partner universities across the world with which we are involved in various collaborative activities that includes student exchange, staff exchange, joint research and joint publications. The Institution actively takes part in several bilateral programmes with the objective of promoting relationships with Countries across the world. We have international students, researchers and academic staff members in our campus through international exchange.

In a truly globalised institution, everyone should have opportunities to acquire international exposure, and career experience. Sathyabama aims at promoting internationalisation and believes that internationalisation strategies are to be driven by educational imperative. The University wishes to provide international exposure and learning experience to students and thereby improving their employability through Student mobility programmes. The University also provides opportunity to the Faculty members to network and learn among international counterparts through staff exchange programmes. Our Institution sends faculty members on exchange programmes to partnering Universities and receives Faculty members from the Partnering Universities across the world.

To promote internationalization we focus on cooperation with universities and other partners worldwide.

We work towards internationalization with the following goals

1. Promoting and supporting international research cooperations and research activities
2. Encouraging and supporting international mobilities for students, faculty and researchers.



OUR STUDENTS AT MAHSA UNIVERSITY, MALAYSIA

17.5 Erasmus Plus-International Credit Mobility Programme

We have association with some of the Universities in European Countries through the Erasmus+ International Credit Mobility Project. We have sent our faculty members on exchange to a Poland University through Erasmus Plus Exchange Programme funded by the European Union. Two of our faculty members have been to Powislanski College in Kwidzyn, Poland IN 2019.



17.6 Mevlana Exchange Programme

Our Institution has signed Mevlana Exchange Protocol with some of the Universities in Turkey, to initiate Mevlana Exchange Programme. Mevlana Exchange Programme is a programme funded by Turkish Higher Education Council, which aims the exchange of students and academic staff between the Turkish higher education institutions and higher education institutions of other countries. Our students go on exchange and undergo one semester in Universities at Turkey under the Mevlana Exchange Programme.



OUR FACULTY MEMBERS AT TURKEY SELECTED UNDER MEVLANA EXCHANGE PROGRAMME



OUR STUDENTS AT TURKEY SELECTED UNDER MEVLANA EXCHANGE PROGRAMME

17.7 Visiting International Professors

Our Institution invites Professors working in Universities abroad as Visiting International Professors, who come and work for a period ranging from 2-12 weeks. We have Professors from France, Malaysia, Singapore, Bangladesh, and Indonesia working with us.

Collaborations

Collaboration	Number
International Universities	153
National Universities	06
National - Research & Development Organizations	34
National Industries	45

17.8 INDONESIAN DELEGATION VISIT TO OUR INSTITUTION

An Indonesian Delegation comprising of Rectors, Vice Rectors and Deans representing several Universities in Indonesia visited our Institution and discussed on the possibilities of collaborations.



Visit of Indonesian Delegation

A GLIMSE OF MoU SIGNING WITH INTERNATIONAL UNIVERSITIES



17.9 FICCI HE Delegation to Korea, April 7-13, 2019

The Vice Chancellor of Sathyabama visited South Korea as a member of FICCI Higher Delegation to South Korea, an initiative of Federation of Indian Chambers of Commerce and Industry (FICCI) to improve the bilateral relations between India and South Korea.

This visit has facilitated the development of strong and meaningful partnerships with some of Korea's leading research organizations, top educational institutions and Companies. Meetings with the University officials, company representatives, Ministry officials and other Korean delegates were highly productive and facilitated exchange of ideas. It was an opportunity to learn the best practices, opportunity to observe the growth, advancements and technological developments of the South Korean Institutions.

Following are the key benefits from the visit to South Korea:

- Yonsei University – Discussions with Yonsei University about the Post-Doctoral Programmes gave an insight to start Post-Doctoral Programmes with Fellowship at our Institution.
- Korea Advanced Institute of Science & Technology (KAIST) – The opportunity to witness the Laboratories, cutting edge research facilities and display of innovative products at KAIST has given an idea to adopt, apply and create similar facilities at our Institution.
- National Institute of Lifelong Education (NILE)- We are taking steps at our Institution to set up Skill Development Centre for training our staff members in the middle age on cutting edge research areas.
- Korea University – Received input as how to strengthen research Infrastructure with regard to Material and Automobile Engineering.
- With Institutions like Hyundai Motor Group University and Samsung Human Resource Development Centre we are trying to have partnership for initiating Student Internship and faculty training.



FICCI Delegation to South Korea

17.10 INTERNATIONAL RESEARCH COLLABORATIONS

Our Scientists and researchers work jointly with international researchers. The following is the list of the International research collaboration for the year 2019.

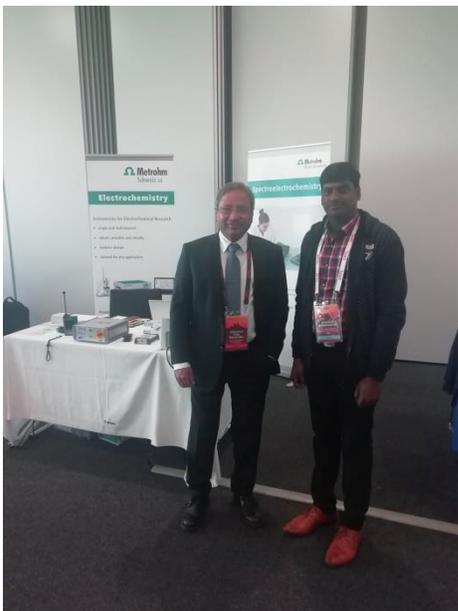
	Scientist Name	Name of the laboratory/ Institute	Year of the Collaboration	Outcome of the Collaboration
1.	Dr. Aurel Radulescu	Jülich Centre for Neutron Science (JCNS), Garching, Germany	2019	Joint Research Publication
2.	Dr. M. Rajesh Kumar	Institute of Natural Science and Mathematics, Ural Federal University, Russia	2019-2020	Joint Research Publication
3.	Dr. R.V. Mangalaraj	Advanced Ceramics and Nanotechnology, Department of Materials Engineering, University of Concepción, Concepción, Chile	2019-2020	Joint Research Publication
4.	Dr. Ralf Schweins	Institut Laue-Langevin (ILL), Grenoble, France	2019	Joint Research Publication
5.	Dr. Vinita Vishwakarma	Clement O. Ogunkunle, Ph.D., Department of Plant Biology/ University of Ilorin/ Nigeria	2016-2020	Joint Research Publication

6.	Dr. Vinita Vishwakarma	Centre for Technology in Water and Waste water (CTWW), University of Technology Sydney (UTS), Australia	2019-2021	Joint Research (SPARC)
7.	Dr. Vinita Vishwakarma	Centre for Technology in Water and Wastewater (CTWW), University of Technology Sydney (UTS), Australia	2019-2021	Joint Research SPARC Project
8.	Dr. Vinita Vishwakarma	Dr. DEEH DEFO Patrick Brice, University of Dschang, Cameroon	2017-2020	Joint Book Publication CV Raman and RTF-DCS fellowship
9.	Prof. Peter Schurtenberger	Lund University, Sweden	2019	Joint Research Publication
10.	Prof. Ulf Olsson	Lund University, Sweden	2019	Joint Research/ Joint Research Publication
11.	Dr Thanga Suja	National Pingtung University of Science and Technology, Taiwan	2019	Oryzacystatin:potent phytocystatin characterized, Joint Research Publication
12.	Dr Thanga Suja	University of California, Riverside, USA	2019	Joint Research

17.11 Post-Doctoral Fellowships/Recognitions Received by Faculty and Students during the year 2019

1. Mr. S. Sanjeevi Prasath, Doctoral Candidate of Dr.Brijitta received Visiting Student Support from Lund University, Sweden





2. Dr. J. THEERTHAGIRI received Korean Research Fellowship (KRF) for Post-Doctoral Programme at Department of Chemistry and Research, Gyeongsang National University, South Korea, (July 2019 – August 2020).
3. Mr. P. VENGATESH, Doctoral Candidate of Dr. T.S. SHYJU, awarded travel grant from DST-SERB through International travel scheme (ITS) support, to present his work in PSCO-2019 Conference held at EPFL, Switzerland, during 30th September 2019 to 2nd October 2019.
4. Dr. Brijitta received European Research Council (ERC) Post-Doctoral Fellowship at Lund University, Sweden, (2017 – 2019).
5. Mr. G. DURAI received fund for Research internship (Sep-2018 to Feb-2019) at Department of Medicinal and Applied Chemistry, Kaohsiung Medical University (KMU), Taiwan through Taiwan Education Experience Program (TEEP Asia@2018) funded by Ministry of Education (MoE), Taiwan
6. Mr. S. AJITH KUMAR, received fund to pursue Research internship (July-2018 to Jan-2019) at Department of Materials Science and Engineering, National Dong Hwa University, Taiwan and Visiting scholar at Department of Bio-Chemistry, Tzu Chi University, Hualien City, Taiwan under Taiwan Education Experience Program (TEEP Asia@2018) funded by Ministry of Education (MoE), Taiwan Scientists Find Simple Method to Synthesise Materials for Energy of the Future - Sputnik International(Design and developed novel method for preparation large-scale perovskites).Link:<https://sputniknews.com/science/202008171080146922-scientists-find-simple-method-to-synthesise-materials-for-energy-of-the-future/>



7. Mr. ARJUN P received fund from DST_SERB to Pursue Research at Purdue University, USA on an Indo-US Purdue Partnership Programme since Jan 2019.



8. Dr. R. Rajesh Kannan is sponsored by SERB-DST to visit Purdue University as Visiting Scientist.

9. University of Hyogo, Japan – *Perovskite Solar Cells*.

10. Indian Institute of Madras, Chennai, India – *Energy Storage applications*.

11. CSIR-Central Electrochemical Research Institute (CSIR-CECRI) - *Sensor and Storage applications*.

12. Technological Development Unit (UDT), University of Concepcion, Coronel Industrial Park, Coronel, Chile - *Water splitting applications*.

13. Institute of Natural Science and Mathematics, Ural Federal University, Yekaterinburg 620002, Russia - *Development of new magnetic materials*.

14. King Saud University, Kingdom of Saudi Arabia – *Photocatalytic Applications*

15. Dr. V. Karthick was awarded the prestigious “Indo-Japanese Joint Project on Establishment



of Young Researcher Fellowship” Program funded by Japan Society for Promotion of Science (JSPS) and Indian National Science Academy (INSA) for the year 2019 to work at

International Center for Materials Nano architectonics (MANA), National Institute for Materials Science (NIMS), Tsukuba, JAPAN.

16. Dr. K.Govindaraju and Dr. Doron Shkolnik from The Robert H. Smith Institute of Plant Sciences & Genetics in Agriculture, The Hebrew University of Jerusalem, Rehovot 76100, Israel are currently working on molecular mechanism of nanoparticles to promote seed germination and seeding development



17. Parameswaran Vijayakumar collaborates with Dr. Vincent Laizé and Dr. M. Leonor Cancela, Paulo J. Gavaia, João Carneira, Centre of Marine Sciences (CCMAR), University of Algarve, Campus de Gambelas, 8005-139 Faro, Portugal
18. Parameswaran Vijayakumar collaborates with Dr. TohruMekata, Nansei Main station, National Research Institute of Aquaculture, Japan Fisheries Research and Education Agency, Mie 519-0193, Japan.
19. Centre for Remote sensing is engaged in international collaboration under Research Training Fellowship for Developing Country Scientist (RTF-DCS) scheme of DST. Under this scheme CRSG is collaborated with **Institute of Geography, Mongolian Academy of Sciences**. DST had sanctioned an amount of Rs 4,00,000/-as Fellowship, TA, DA for an international student **Ms.NandintsetsegNyamOsar**. She will be trained by mentors of Sathyabama Institute of Science and Technology. **Dr Anoop Kumar Mishra and Dr K Nagamani** will train the student and will work on ‘Exploring convective clouds using satellite observations which will be helpful for disaster mitigation.

17.12 FACULTY EXCHANGE/RESEARCH PROGRAMME-2019

Our faculty members visited International Universities on academic and research exchange programmes. The following is the

S.NO	NAME OF THE FACULTY	DEPT	UNIVERSITY	DURATI ON	PROGRAM ME	PERI OD
1.	Dr. J. RAMKUMAR	Centre for Energy Research	University of Concepcion, Concepcion, Chile	3 Years	Research (FONDECYT)	March 2016-Feb 2019
2.	Dr. T.S. SHYJU	Centre for Energy Research	University of Concepcion, Concepcion, Chile	3 Years	Research (FONDECYT)	March 2016-Feb 2019
3.	Dr. BRIJITTA J	Centre for Nanoscience and Nanotechnology	University of Lund, Sweden	2 Years	European Research Council (ERC), Postdoctoral Research Fellowship	2017-2019
4.	Dr. BEEMA SHAFREEN	Centre for Nanoscience and Nanotechnology	Smart Digital Technologies LLC, Oman	2 Years	Faculty Exchange	2017-2019
5.	Dr. VINITHA EBENEZER	Centre for Climate Change Studies	Mount Allison University, Canada	1 Year	Postdoctoral Research Fellowship	April, 2018 – March 2019
6.	Mr. DURAI	Centre for Nanoscience and Nanotechnology	Kaohsiung Medical University, Taiwan	6 Months	Short – Term Research Internship (STRI)	Sep 2018-March 2019
7.	Dr. CHENNA KESAVALU	CHEM	University of Strausburg, France	10 Months	Research Programme	2018-2019
8.	Mr. ARJUN P	Centre for Nanoscience and Nanotechnology	Purdue University, USA	1 Year	Indo-US Purdue Partnership Programme (DST-SERB)	Jan 2019-Jan 2020

9.	Dr. KISHORE SONTI	ECE	Powislanski University at Kwidzyn, Poland	1 Week	Erasmus Plus	May 2019
10.	Dr. J. KARTHIKEYAN	CHEM	Powislanski University at Kwidzyn, Poland	1 Week	Erasmus Plus	May 2019
11.	Dr. MADAN KUMAR	Centre for Nanoscience and Nanotechnology	University of Nebraska, Omaha, USA	2 Years	Senior Post Doctoral Fellow	June 2019-June 2021
12.	Mr. SANJEEVI PRASATH S	Centre for Nanoscience and Nanotechnology	Lund University, Sweden	1 month	Visiting Research Student	June-July 2019
13.	Dr. J. THEERTHA GIRI	Centre for Nanoscience and Nanotechnology	Gyeongsang National University, South Korea	2 Years	Korean Research Fellowship (KRF)	July 2019-July21
14.	Dr. G. SUNDARI	ECE	UNIS, Brazil	1 Week	Faculty Exchange	July 2019
15.	Dr. R.RAJESH KANNAN	Centre for Nanoscience and Nanotechnology	Purdue University, USA	1 Month	Bilateral Visiting Faculty, DST-SERB, (OVDF)	July 2019-Aug 2019
16.	Dr. MAHARSHI BHASWANT C	Centre for Nanoscience and Nanotechnology	Kyoto University, Japan	1 Year	Long Term ICMR-DHR International Fellowship for Young Indian Biomedical Scientists	2019-2020
17.	Mr. KAJA BANTHANAWAS	MECH	Tsinghua University, Taiwan	2 Months	Summer School under Global Engineers Scholarship	June-July 2019
18.	Mr. MADHAN KUMAR	ECE	University Technology Malaysia, Malaysia	1 Week	Faculty Exchange	August 2019

19.	Dr. R. SUBASHINI	IT	Nottingham Trent University, Uk	1 Week	Faculty Exchange	Sep 2019
20.	Dr. BEVISH JINILA	IT	Nottingham Trent University, Uk	1 Week	Faculty Exchange	Sep 2019
21.	Dr. G. MATHIVANAN	IT	Daffodils International University	1 Week	Faculty Exchange	Sep 2019
22.	Dr. A. JESUDOSS	CSE	Daffodils International University	1 Week	Faculty Exchange	Sep 2019
23.	S. MANIGANDAN	AERO	Kaohsiung medical university, Taiwan	7 Months	Research	Oct 2019- May2020
24.	Dr. DILSHAD SHAIK	LAW	Syiah Kuala University, Indonesia	1 Week	Faculty Exchange	Oct 2019
25.	Dr. A. CHITRA DEVI	CAPIR	University Teknologi Malaysia, Malaysia	1 Week	Faculty Exchange	Oct 2019
26.	Dr. PREETHI SHESHADRI	CAPIR	University Teknologi Malaysia, Malaysia	1 Week	Faculty Exchange	Oct 2019

17.13 OUTCOMES OF THE COLLABORATIVE RESEARCH

PUBLICATIONS (2019)

1. Muthulakshmi, Lakshmanan, Anumakonda Varada Rajalu, Gobi Saravanan Kaliaraj, Suchart Siengchin, Jyotishkumar Parameswaranpillai, Ramiah Saraswathi, "Preparation of cellulose/copper nanoparticles bionanocomposite films using a bioflocculant polymer as reducing agent for antibacterial and anticorrosion applications", Composite part B: Engineering, 10.1016/j.compositesb.2019.107177, IF : 7.64
2. J.Aravind kumar - Amarnath, D.J., Jabasingh, S.A., Kumar, P.S., Anand, K.V., Narendrakumar, G., Namasivayam, S.K.R., Krithiga, T., Sunny, S., Pushkala, S.P. Yuvarajan, D, "One pot Green Synthesis of Nano magnesium oxide-carbon composite: Preparation, characterization and application towards anthracene adsorption", Journal of Cleaner Production, <https://doi.org/10.1016/j.jclepro.2019.117691>, IF : 7.25

3. Kumar, Amit, Maria Cristina Buia, Anna Palumbo, Mohamed Mohany, Mohammed AM Wadaan, Wael N. Hozzein, Gerrit TS Beemster, and Hamada AbdElgawad, "Ocean acidification affects biological activities of seaweeds: A case study of *Sargassum vulgare* from Ischia volcanic CO₂ vents", *Environmental Pollution*, <https://doi.org/10.1016/j.envpol.2019.113765>, IF : 6.79
4. KK Thiyagarajan, G. Kalaiarasi, "A Review on Near-Duplicate Detection of Images using Computer Vision Techniques", *Archives of Computational Methods in Engineering*, <https://doi.org/10.1007/s11831-020-09400-w>, IF : 6.73
5. Nirmala, N., S. S. Dawn, C. Harindra, "Analysis of Performance and Emission characteristics of Waste cooking oil and *Chlorella variabilis* MK039712.1 biodiesel blends in a Single cylinder, four strokes Diesel", *Renewable Energy*, <https://doi.org/10.1016/j.renene.2019.08.133>, IF : 6.27
6. Jayaprabakar.J, Karthikeyan Alagu, Prabhu Appavu, Nivin Joy, Parthipan Jayaram, Anish Mariadoss, "Enzymatic production of biodiesel using lipase catalyst and testing of an unmodified compression ignition engine using its blends with diesel", *Renewable Energy*, <https://doi.org/10.1016/j.renene.2019.06.061>, IF : 6.27
7. D. Dinesh Kumar , Revati Rani, Niranjana Kumar, Kalpataru Pandad, A.M. Kamalan Kirubaharana, P.Kuppusami, R.Baskaran, "Tribiochemistry of TaN, TiAlN and TaAlN coatings under ambient atmosphere and high-vacuum sliding conditions", *Applied Surface Science*, [10.1016/j.apsusc.2019.143989](https://doi.org/10.1016/j.apsusc.2019.143989), IF : 6.18
8. Preethi L K, Tom Mathews, "Electrochemical tuning of heterojunctions in TiO₂ nanotubes for efficient solar water splitting", *Catalysis Science and Technology*, <https://doi.org/10.1039/C9CY01216H>, IF : 5.72
9. S.Manigandan, R.Sarweswaran P.Booma Devi Yasin Sohret Andrii Kondratiev, S.Venkatesh M.Rakesh Vimala J.Jensin Joshuab, "[Comparative study of nanoadditives TiO₂, CNT, Al₂O₃, CuO and CeO₂ on reduction of diesel engine emission operating on hydrogen fuel blends](#)", *Fuel*, [10.1016/j.fuel.2019.116336](https://doi.org/10.1016/j.fuel.2019.116336), IF : 5.58
10. S.Karthick Raja Namasivayam, A N Nishanth, Arvind Bharani R S, Kiran Nivedh, Nawaz Hussain Syed, Rosario Samuel R, "Hepatitis B-surface antigen (HBsAg) vaccine fabricated chitosanpolyethylene glycol nanocomposite (HBsAg-CS-PEG- NC) preparation, immunogenicity, controlled release pattern, biocompatibility or nontarget toxicity", *International journal of biological macromolecules*, [10.1016/j.ijbiomac.2019.09.175](https://doi.org/10.1016/j.ijbiomac.2019.09.175), IF : 5.16

11. Arul Maximus Rabel, S. Karthick Raja Namasivayam, M.Prasanna, R.S. Arvind Bharani, "A green chemistry to produce iron oxide – Chitosan nanocomposite", International journal of biological macromolecules, 10.1016/j.ijbiomac.2019.07.158, IF : 5.16
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13. S. Ajith Kumar, P.Kuppusami, S.Amirthapandian, Yen-PeiFu, "Effect of Sm co-doping on structural, mechanical and electrical properties of Gd doped ceria solid electrolytes for intermediate temperature solid oxide fuel cells", International Journal of Hydrogen Energy, <https://doi.org/10.1016/j.ijhydene.2019.10.098>, IF : 4.94
14. S.Manigandan, Vinoth Kumar Ponnusamy, P. Booma Devi, Sunday Ayoola Oke, Yasin Sohret, S. Venkatesh, M. Rakesh Vimal, P. Gunasekar, "Effect of nanoparticles and hydrogen on combustion performance and exhaust emission of corn blended biodiesel in compression ignition engine with advanced timing", International journal of Hydrogen energy, [10.1016/j.ijhydene.2019.11.172](https://doi.org/10.1016/j.ijhydene.2019.11.172), IF : 4.94
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19. T.Thaj Mary Delsy, N. M. Nandhitha, B. Sheela Rani, “Feasibility of spectral domain techniques for the classification of nonstationary signals”, Journal of Ambient Intelligence and Humanized Computing, <https://doi.org/10.1007/s12652-020-02220-7>, IF : 4.59
20. L. Mary Gladence, V. Maria Anu R. Rathna, E. Brumancia, “Recommender system for home automation using IoT and artificial intelligence”, Journal of Ambient Intelligence and Humanized Computing, <https://doi.org/10.1007/s12652-020-01968-2>, IF : 4.59
21. Dr. A. Sivasangari, P. Ajitha, Immanuel Rajkumar, S. Poonguzhali, “Emotion recognition system for autism disordered people”, Journal of Ambient Intelligence and Humanized Computing, DOI: [10.1007/s12652-019-01492-y](https://doi.org/10.1007/s12652-019-01492-y), IF : 4.59
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23. A.Antony Mary, A.Amutha, “A Study On Domatic Number of Cycle Related Graphs”, Journal of Ambient Intelligence & Humanized Computing, DOI:10.1007/s12652-020-01740-6, IF : 4.59
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