

Centre of Excellence (CoE-II)
on
“SUSTAINABLE GREEN MATERIALS”
at
School for Advanced Research in Petrochemicals (SARP) –
LARPM, CIPET, Bhubaneswar

1. Brief Note on The Project work: “Centre of Excellence for Sustainable Green Materials”

The Centre of Excellence (CoE) on ‘Sustainable Green Materials’ was initiated with a major aim to address the issues of increasing quantum of plastics waste from various sources. Also, the project aims at devising specific methodologies pertaining to substitution of petroleum based feedstock by utilizing green materials / natural resources with an objective to reduce the global carbon footprints. Technology advancement has been exponential ever since the versatility and stability of plastics to be used for commodity as well as sophisticated applications was recognized. This technology growth has had its toll on the environment through increased plastics wastes and depleted natural resources. Thus, the need-of-the-hour is to formulate ways to utilize renewable resources to meet the demand for plastics while designing strategies for recycling the end-of-life products.

Thus, the CoE was deigned to obtain the above goals and its objectives were designed as,

- Creation of technical talents with ample scientific knowledge through Doctorate and Post-Doctorate programs.
- Establishment of a Biodegradation set-up for analyzing the extent of degradability of various plastic materials / products under controlled Vermi composting conditions.
- Methodizing a route for synthesis of bio-resins from vegetable/plant oils and tailoring their curing characteristics for applications like bio-adhesives and coatings.
- Development of composites and nanocomposites with maximum bio-content – bio-resins reinforced with natural fibers and their nano-derivatives.
- Strategies for eco-friendly recycling of end-of-life electronics and their value addition for high-end applications.

2. Advantages of Project Work

Bioplastics are on the verge of broad market introduction, leaving the niche areas they have occupied in their infancy. The chemical and plastics industries expect the new types of plastics to compete with conventional, petroleum-based plastics. Biopolymers are processed

into molded parts, semi-finished goods or sheets. Because of their degradation properties, biopolymers are especially suited for packaging, catering products, garden and landscaping products, materials for medical use and other short-lived products.

The major issues pertaining to depletion of non-renewable resources as well as waste plastic disposal has been effectively addressed. Plastic packaging is posing an enormous threat to the ecology owing to its disposal issues. These are being replaced with paper bags, which again will disturb the ecology, this time for raw materials. Further, the increase in automobile usage has forced the manufacturers to develop vehicles with high fuel efficiency for competition in the market, which may be directly related to the weight of the auto-parts. This may be achieved by substituting metals with plastic components. Thus, it has become a pre-requisite to find an effective and harmless solution for these issues. Researchers have been investigating the viability of polymers of bio-origin for wide range of applications.

The bioresins synthesized from the vegetable oils are eco-friendly materials with reduced CO₂ emissions. These materials can be effectively used in the automotive sectors, packaging etc. as a viable alternative to the existing petroleum based thermosets and thermoplastics. Further, bio-based adhesives can open up new venture in repair of the fractured composites with its faster curing mechanism under room temperature and other curing conditions. The research in this direction is still in infancy stage. Hence, the developed material from CoE would address the requirement of new materials that can cater to the needs of the industries and society.

CIPET along with its collaborators who are the leading players in the field of biomaterials, established a novel methodology for development of sustainable green or bio materials for use in Automotive sector, Adhesives & Coatings as well as Electronics. Further, validated technology shall be transferred to pertinent industries for commercialization, thus reducing their labour. The labour utilized in processing recycled plastic waste shall be diverted in developing eco-friendly materials, which may create newer job opportunities.

The need of the hour is an efficient technique to recycle plastics from consumer electronics thus preventing land filling and other toxic methods. Research in this area is limited despite having a greater potential to solve many of the environmental issues. Hence, the technology developed shall be transferred to the industrial partner for further validation and commercialization. A composition has been formulated wherein a combination of mixed plastics and virgin material forms a 'ready-to-use' master batch that may be further used for product development by the industries.

3. Agreements made with following for technology transfer/ commercialization of the technology

Bio-based Polyurethane -Ultra violet (UV) resistance coatings have been developed for automobile liner applications. The synthesis parameters and performance characteristics have been optimized and the technology transfer to M/s Artlux Mexico is under progress. The final round of trials for commercial onsite application at M/s Artlux Mexico has been scheduled during on 2nd week of December 2019.

Eco-friendly strategy for recycling of plastics retrieved from WEEE has been established. The collected and sorted electronic components have been tailored employing traditional processing techniques and parameters for developing value-added products. A E-waste recycling unit for value addition of plastics waste has been established by SARP:LARPM, CIPET Bhubaneswar at CIPET, Paradeep, Odisha. The developed technology has also been transferred to an entrepreneur on 22nd June 2018. The hand holding to the entrepreneur is completed, development to plant scale is under progress.

Bio-based green adhesives from vegetable oils have been investigated and developed for composite material used in automotive sectors. The material safety datasheet has been generated and the expression of interest shall be floated shortly. The following industry has shown their interest to take the assignment.

- M/s Roidec India Chemicals Pvt. Ltd., Haryana,
- M/s Nature-Tec Pvt. Ltd., Chennai
- M/s M/s Artlux Toffliners, Mexico
- M/s E-Parisaraa Pvt. Ltd

4. Publications on theProject

- 13 nos. of Ph.Ds were generated from the CoE; 01 no. of Pool Scientist and 02 nos. of Research Associates have also been engaged under the project to achieve the targeted deliverables.
- More than 66 nos. of research papers have been published in peer-reviewed International Journals
- 5 Book Chapters have been published with the International Publishers

5. Details of Patents granted & Technology for the project

No. of Patents (Granted/Filed):	01
No of Patent in process:	02
Technology Transferred	02

6. Equipment/ Machines available at CoE

Compositing Site



Biodegradability test set-up with Vermi-composting facility

Test set-up constitutes of the following equipment:



Incubator, M/s Orbitek India Pvt. Ltd.



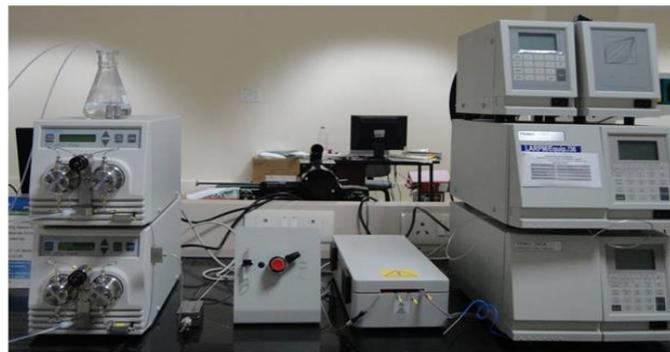
Digester, M/s Technico Laboratory Products (P) Ltd.



***CHN Analyzer, M/s Thermo Scientific,
USA***



***Gas Chromatograph, M/s Perkin
Elmer, USA***



***Gel Permeation Chromatograph, M/s
Waters India Pvt. Ltd.***



Established Plastics waste recycling laboratory

All the aforementioned equipments are being extensively used by the research scholars, scientists and students for various research and developmental activities. The entire test set-up is being utilized for investigating various factors pertaining to degradability of polymeric materials along with bio-based additives with recycling approach.

MoU Signed:



Articulation of Agreement between CIPET & Michigan State University, East Lansing, USA has been signed



MoU between M/s Artlux, Mexico and CIPET

Prototype Developed:



Flexible flooring from waste plastics



End-capped Polyamide Film



PU based coating



Bio-based Adhesive

7. Contact details for further information

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