FOOD PROCESS ENGINEERING LABORATORY

Faculty Details:

Dr. V. SIVAKUMAR
Professor, Department of Chemical Engineering
A.C.Tech Campus, Anna University
Tamil Nadu, India - 600025.
Ph: 044 2235 9122, 044 2235 9169
E-Mail: drvsivakumar@annauniv.edu,
drvsivakumar@gmail.com, drvsivakumar@yahoo.com

About the Laboratory:

The Food Process Engineering Laboratory (FPE) was established as a part of research laboratories in the Department of Chemical Engineering, A.C.Tech, Anna University by Dr.V.Sivakumar, Professor in the year 2015 to study and develop cost-effective, innovative processing methods and technologies in the field of chemical and food technology that tender to current needs in both academic and industrial sector by implementing progressive research methodologies.

The laboratory houses processing equipment and analytical instruments to help in conducting original and inventive research. The lab supports research activities of doctoral researchers and post graduate students and fosters innovative research on food processing technologies in the areas of Extraction, Drying, Food Packaging, Biofuels and Effluent treatment. The current research activities carried out in the lab are

- Extraction of polyphenols, natural colorants and oils from native and underutilized plants, seeds and food wastes using cost effective process technologies.
- Development of biodegradable food packaging solutions from naturally available resources using commercially viable and scalable methods.
- Studies on different drying techniques of underutilized fruits and their effects on the nutritional properties thus creating new supplements with extended shelf life.

- Valorisation of agro industrial wastes to prepare nano particles that find interesting and useful applications in the production of polymer composites.
- Production of biofuels from various indigenous lignocellulosic biomass and vegetable oils to be used as alternative to fossil fuels.
- Development of energy efficient process methods to treat waste water from agro industries and recover them for reuse.

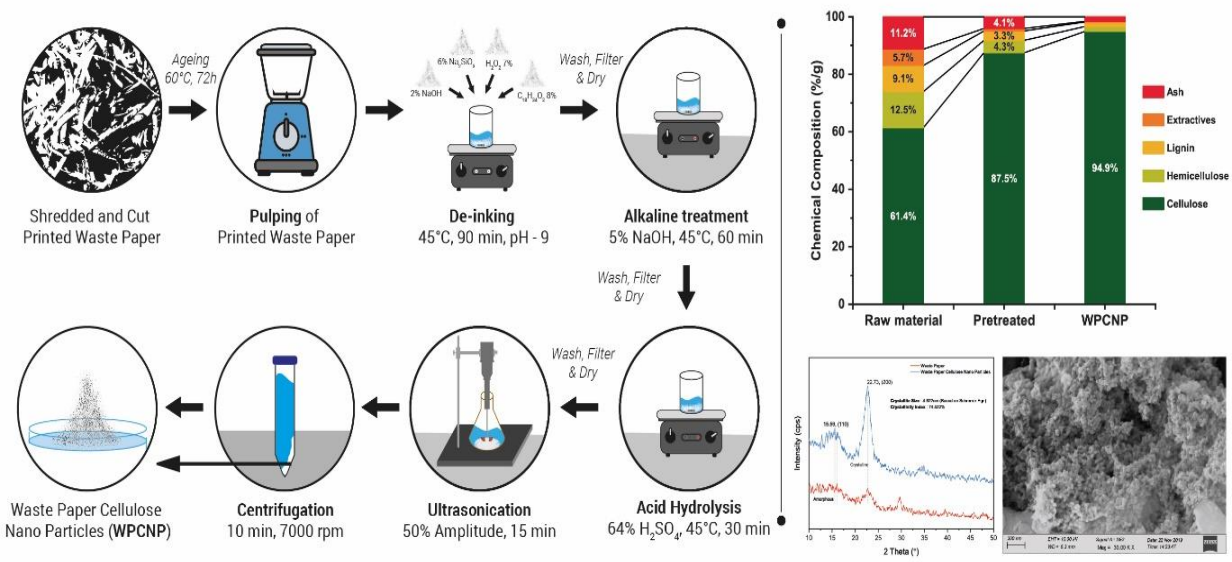
The lab aims to establish a lab scale bio refinery unit for complete utilization of biomass by isolating cellulose, lignin and hemicelluloses and producing biofuels which would be a milestone in the field of waste management and valorization. Adding to that, the lab also targets to design and develop electrocoagulation units for continuous treatment of agro-based effluents.

Researchers are motivated and guided to acquire funding for their research work from several central and state government departments and also in the commercial sector. Research works carried out by the lab are published in various International and National peer reviewed journals.

Research profiles || Click the Icons to View the respective profiles

Scopus Google Scholar Web of Science™ ORCID

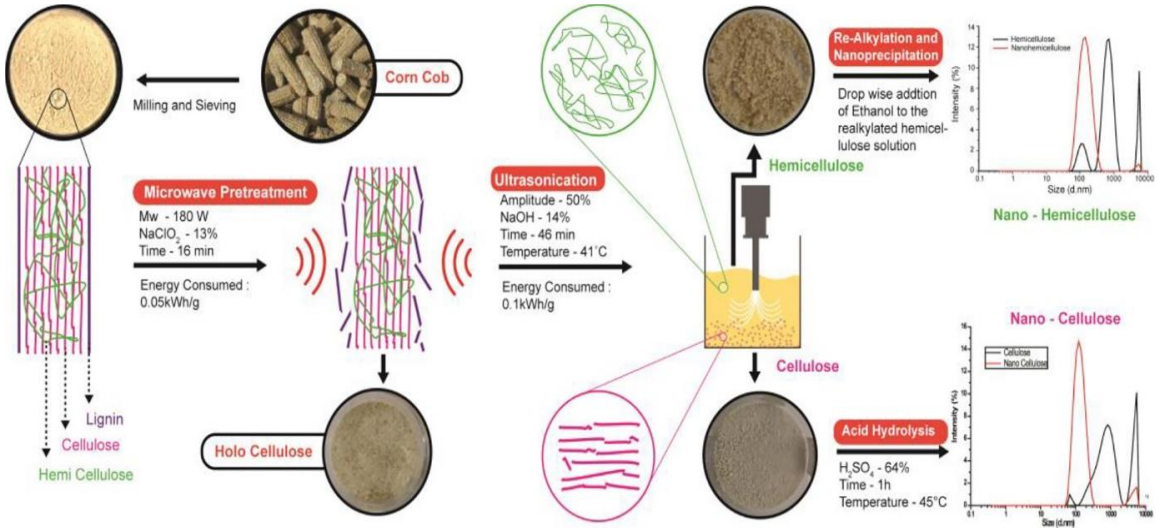
Accomplishments:



- Printed wastepaper has been valorized into cellulose nanoparticles

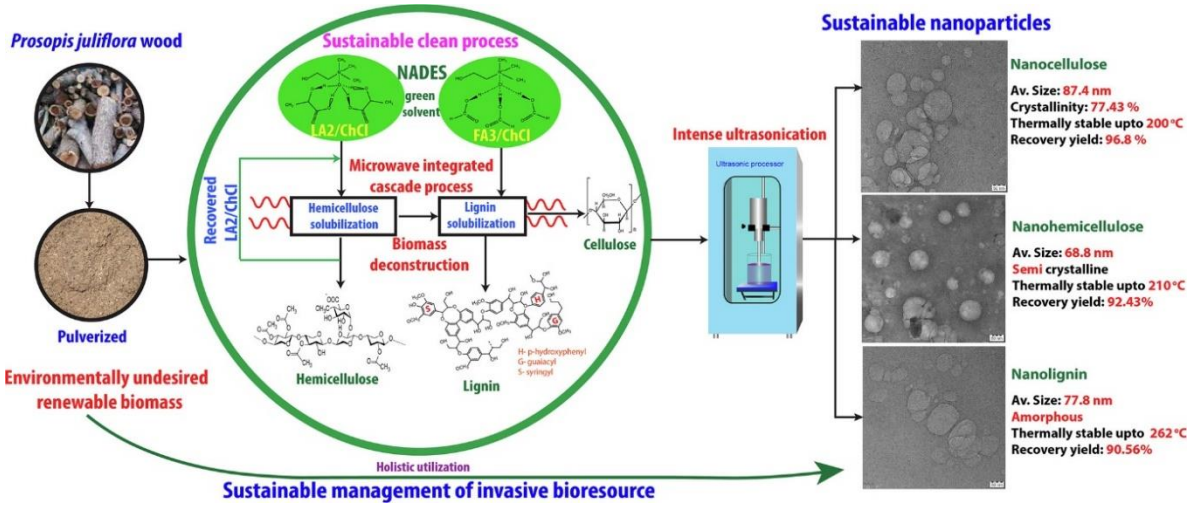
- Deinking followed by alkylation and acid hydrolysis yielded a 76.4% recovery
- Cellulose I structure with 74.52% crystallinity has been attained
- WPCNP showed good particle dispersion (-39.52 mV) and thermal stability (279.95°C)

Reference: Palanichamy, P., Venkatachalam, S., & Gupta, S. (2022). Improved recovery of cellulose nanoparticles from printed wastepaper and its reinforcement in guar gum films. Biomass Conversion and Biorefinery, 1-13.



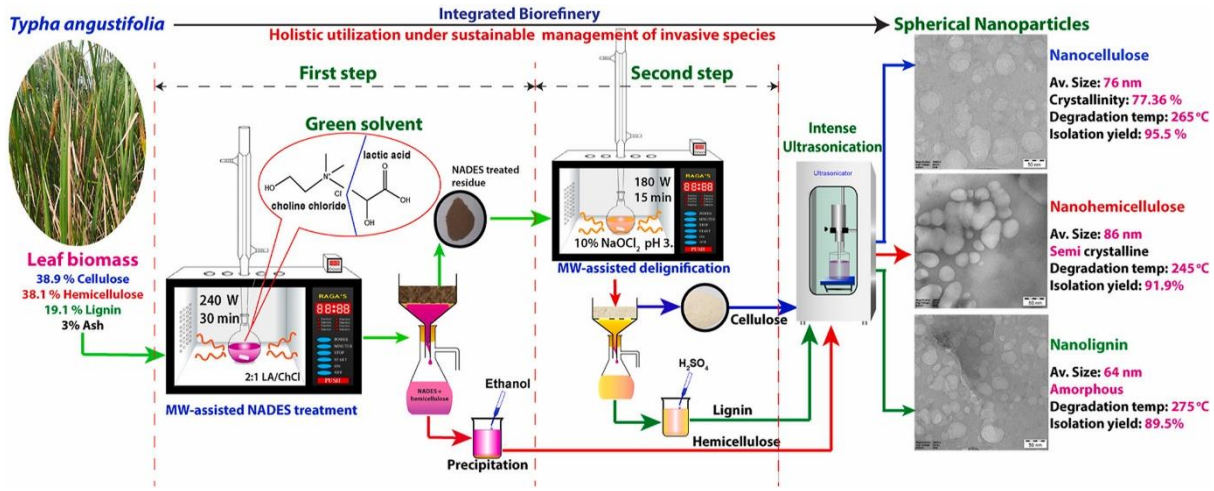
- Valorization of corncob to cellulose & hemicellulose nanocrystal at minimal energy
- Microwave process results in 97.31% delignification with 4 times less energy.
- Ultrasound yields 0.445 g/g of cellulose & 0.327 g/g of hemicellulose at faster rate.
- Nanocellulose and hemicellulose were of a mean size of 131.4 and 130.4 nm.
- Nanocellulose structure with a crystallinity index of 72.36% was retained.

Reference: Louis, A. C. F., & Venkatachalam, S. (2020). Energy efficient process for valorization of corn cob as a source for nanocrystalline cellulose and hemicellulose production. International Journal of Biological Macromolecules, 163, 260-269.



- Cascade production of nanocellulose, nanohemicellulose and nanolignin from Prosopis juliflora biomass.
- Two-stage cascade process integrated with microwave gives a higher recovery yield (96.8 % cellulose, 92.43 % hemicellulose and 90.56 % lignin).
- 80 % of LA2/ChCl NADES and 98 % of ethanol were recovered and reused.
- The produced nanocellulose, nanohemicellulose and nanolignin typically had a spherical structure with an average particle size of 87.4 ± 5.1 nm, 68.8 ± 2.1 nm, and 77.8 ± 2.6 nm.

Reference: Rani, B. S. J., & Venkatachalam, S. (2022). Cleaner approach for the cascade production of nanocellulose, nanohemicellulose and nanolignin from Prosopis juliflora. *Carbohydrate Polymers*, *294*, 119807.



- New biorefinery process was developed for limiting the processing waste.
- Isolated Cellulose, hemicellulose and lignin nanoparticles with higher recovery yield.

- Spherical shape of the nanoparticles opens a window for wide range of applications.

Reference: Rani, B. S. J., & Venkatachalam, S. (2022). A neoteric approach for the complete valorization of Typha angustifolia leaf biomass: A drive towards environmental sustainability. *Journal of Environmental Management*, *318*, 115579.

List of Major Equipment:

S.No.	Name of the Equipment
1.	Universal Testing Machine
2.	Ultrasonic Processor
3.	Incubator Shaker
4.	Research Centrifuge
5.	Fume Hood
6.	Vacuum Oven
7.	Hot Air Oven
8.	Visible Spectrophotometer
9.	Laminar Air Flow Chamber
10.	Microwave Assisted Extractor

List of Research Scholars:

S. NO	Name of the Research Scholar	Research Title	Year of passing/Status
1	P. Murthi	Development of ternary blended concrete	15/10/2009
2	K. Nirmal kumar	Studies on suitability of industrial effluents for construction purposes	29/122009
3	K. Senthilkumar	Hydrodynamic studies in three-phase fluidized bed	18/04/2011
4	V. Chitra Devi	Studies on biodecolorization of cibacron reactive dyes	28/04/2011
5	K. Kannan	Hydrodynamic studies on three – phase external loop air lift fluidized bed	08/07/2011
6	P. Akilamudhan	Hydrodynamic studies on three phase internal loop and combined loop air lift reactor fluidized beds	03/01/2012
7	P. Shanmugam	Studies on production of bioethanol and its characterization blending with	15/06/2012

		additives for effective use in diesel engine as diesel -bioethanol blends	
8	R. Sridhar	Studies on electro coagulation techniques for treatment of industrial effluents	04/10/2013
9	R. Senthilraja	Experimental Investigation of Performance, Emission and Combustion Characteristics of a Dual Fuel Engine with Diesel-Ethanol-Vegetable Oil and its ester Blended with Compressed Natural Gas (CNG)	13/08/2014
10	M. Shanmuga Prakash	Studies on Removal of Chromium (VI) and Zinc (II) Ions from Aqueous solution using Biosorption	26/03/2015
11	K.Thirugnana sambandham	Recovery of water from effluents using integrated process techniques	17/07/2015
12	J. Prakashmaran	Studies on Development and Characterization of Starch Based Biodegradable Edible Films	28/07/2015
13	V.Sangeetha	Studies on treatment and recovery of biogas from Sago and Dairy industries effluent	13/01/2016
14	A.Sangamithra	Foam Mat Drying of Muskmelon (Cucumis Melo) Pulp	20/12/2016
15	D. Tiroutchelvame	Studies on osmotic Dehydration of Fruit and Vegetables	27/01/2017
16	A.Sudha	Studies on Production of Bioethanol from Cassava Pulp and Stem	08/06/2017
17	Jeeva S	Ultrasonic Cavitation as A Novel and Energy Efficient Technique for Vegetable Oil Extraction from Agro Products	13/10/2020

18	K.Kannan	Enhancing the Shelf life of Sapodilla (Manilkara zapota) by Value Addition	23/02/2021
19	K.Anbarasi	Extraction of valuable components from underutilized fruits and fruit wastes	20/04/2021
20	L Antony Catherine Flora	Isolation of Nano cellulose and Nano hemicellulose From Agro-Waste Residues and Evaluating Their Reinforcement Effect in Starch Films for Food Packaging Applications	Thesis Submitted
21	J.R. Baby Salini	Production of Nano cellulose, Nano hemicellulose And Nano lignin from Invasive Plant Biomass and Their Application as Reinforcement in Chitosan Films for Food Packaging	Synopsis Submitted
22	Jony Blessing Manoj	Extraction of bioactive compounds from plants	Ongoing
23	Anupama.J.R	Extraction of bioactive compounds from natural resources	Ongoing
24	P. Prabhu	Development of biodegradable films from natural resources	Ongoing
25	E. Ann Raeboline Lincy	Sustainable technology for extraction of phytochemicals from spices using green solvents	Ongoing
26	B. Chindumathi	NADES based extraction of valuable compounds from food processing wastes	Ongoing
27	S. Shobana	Production of Biofuels from Agricultural Wastes using Designer Solvents	Ongoing

Images to add: