

An Indian-Australian research partnership

Project Title:

Development of green biorefinery technologies from lignocellulosic feedstock

Project Number

IMURA0857



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Research Clusters:

Research Themes:

Highlight which of the Academy's CLUSTERS this project will address?

(Please nominate JUST one. For more information, see www.iitbmonash.org)

Highlight which of the Academy's Theme(s) this project will address?

(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1	Material Science/Engineering (including Nano, Metallurgy)	1	Advanced computational engineering, simulation and manufacture
2	Energy, Green Chem, Chemistry, Catalysis, Reaction Eng	2	Infrastructure Engineering
3	Math, CFD, Modelling, Manufacturing	3	Clean Energy
4	CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control	4	Water
5	Earth Sciences and Civil Engineering (Geo, Water, Climate)	5	Nanotechnology
6	Bio, Stem Cells, Bio Chem, Pharma, Food	6	Biotechnology and Stem Cell Research
7	Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng	7	Humanities and social sciences
8	HSS, Design, Management	8	Design

The research problem

This project will focus on developing broadly applicable biorefinery technologies for discarded and/or by-products of fruit and vegetable production and processing. Seasonal supply variability of different fruits and vegetables requires that common technologies can be applied to multiple feedstock options to isolate common chemical components. Hence a biorefinery can operate all year around where different feedstocks are available. India and Australia have a number of common fruit and vegetable products where development of an integrated biorefinery approach will provide economic benefits to the industries and more sustainable utilization of the agricultural produce (eg mango, pomegranates, lupin crop residues, bananas, pineapple). For example, banana production produces significant waste at the point of production due to fruit spoilage and fruit rejection, as well as banana leaf and stems from the plants. A balance needs to be established between maintaining soil health (ie returning some organic matter to the soil) and optimizing the use of other parts of the plant for recovery of pectin, antioxidants, vitamins, fibre and other valuable banana plant and fruit components. This project will also include a Life Cycle Analysis of the biorefinery approach to understand sustainability of developed processes.

Project aims

- Developing a model biorefinery from multi feedstock (horticultural and agricultural residues)
- Evaluating green pathways for economical extraction of cellulose, hemicellulose, pectin, reducing sugars, and bioactive compounds
- Develop process models for the conversion of waste into biofuels and value added products and assess the techno-economic feasibility of the biorefinery
- Life cycle assessment of developed biorefineries

Expected outcomes

Highlight the expected outcomes of the project

Demonstration of the feasibility of Biorefineries that are capable of processing a broad range of lignocellulose feedstock from agricultural production.

Knowledge and processes that will make fruit and vegetable processing industries more sustainable and profitable.

Integration of farm production with a broader range of green and sustainable applications of the produce.

How will the project address the Goals of the above Themes?

Describe how the project will address the goals of one or more of the 6 Themes listed above.

The focus on finding new sustainable uses for the utilisation of food processing waste and other agricultural biomass sources, addresses the need for finding renewable feedstocks for **fuels, chemicals and materials**, applying **Green Chemistry** principles (which includes minimizing **Energy** footprint) maximising outputs from **Food** crops. Most of the products have applications in the **Pharmaceutical Industry**. **Biotechnology** routes for a model biorefinery will be the focus of the project.

Capabilities and Degrees Required

List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like.

These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.

A Masters degree or First Class Honours degree (4 years) or equivalent with a strong background in chemistry, chemical engineering, materials science or biotechnology with strong chemistry. Relevant experience in biomass research, processing and analysis is highly desirable (eg through Masters research or work experience). It is highly desirable for applicants to have a good understanding and experience with analytical techniques and interpretation of the outputs from NMR, HPLC, Gas Chromatography, Mass Spectrometry UV Spectroscopy and FTIR.

Potential Collaborators

Please visit the IITB website www.iitb.ac.in OR Monash Website www.monash.edu to highlight some potential collaborators that would be best suited for the area of research you are intending to float.

Relationships with a number of fruit and vegetable processing companies have already been established (pomegranate, corn/beans/peas, pineapple) in Australia and India. A number of these companies have provided some funding for exploratory projects which will link directly into this project proposal.

Select up to **(4)** keywords from the Academy's approved keyword list (**available at <http://www.iitbmonash.org/becoming-a-research-supervisor/>**) relating to this project to make it easier for the students to apply.

Waste to Wealth, Green Chemistry and Renewable energy, Food Innovation