

Project 3_1 Hydrothermal Treatment of Agricultural Waste for High-Value Carbonaceous and Biochemical Products

PC Hub Theme (see list here)
Theme 3: Waste Valorisation – Extraction and Processing Technology
Principal supervisor
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Co-supervisor(s)
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About the project

Based at La Trobe University, the ARC Research Hub for Protected Cropping (PC Hub) is driving transformation across Australia's horticultural and medicinal agriculture industries by advancing protected cropping systems and improving sustainability, crop quality, yield, and production reliability. Through cutting-edge research and close industry collaboration, the PC Hub addresses critical knowledge gaps to unlock the full potential of protected cropping technologies.

We are seeking an enthusiastic and motivated PhD candidate to join our research team investigating the hydrothermal treatment (HTT) of agricultural residues for the production of high-value carbon materials, chemicals, and nutrient-recovered liquid products. This opportunity is ideally suited to candidates with a strong technical background in chemical engineering, environmental engineering, chemistry, or materials science, and a keen interest in biomass valorisation and sustainable technologies.

Agricultural waste streams—rich in lignocellulosic polymers, lipids, proteins, and inorganic nutrients—offer significant potential for conversion into engineered products through hydrothermal carbonisation (HTC). This project will systematically investigate how process parameters, including temperature (150–350 °C), pressure

(saturated steam to subcritical water conditions), residence time (minutes to hours), solids loading, acidity/alkalinity, catalysts (e.g. heterogeneous catalysts, alkali/acid promoters, and metal salts), and biomass pre-treatment methods, influence product selectivity, material properties, and overall process performance.

The PhD candidate will:

- Conduct systematic parametric studies to map reaction pathways and optimise yields of targeted products.
- Employ advanced characterisation (FTIR, GC-MS, LC-MS, XRD, BET, TGA, ICP-OES) to elucidate transformation mechanisms and structure–property relationships.
- Integrate kinetic and thermodynamic modelling to understand conversion behaviour under hydrothermal conditions.
- Evaluate the scalability, environmental performance, and techno-economic feasibility of selected valorisation routes.

The project provides access to high-pressure reactor systems, comprehensive analytical facilities, and strong industry and interdisciplinary research networks.

Eligibility Criteria

We are seeking a candidate with:

- A Bachelor's degree with Honours or a Master's degree in **Chemical Engineering or a related discipline**.
- A strong background in **solvent and membrane separation techniques**.
- Experience with experimental systems for **plant extraction and liquid–liquid separation**.
- Experience in setting up and operating membrane separation units will be highly regarded.
- Familiarity with **analytical techniques** such as High-Performance Liquid Chromatography (HPLC) and Mass Spectrometry.
- Demonstrated strong written and verbal communication skills.
- The ability to work effectively within a multidisciplinary research team.
- **Full English language proficiency**.

How to apply

The PC Hub offers a **limited number** of competitive scholarships.

To apply, please email the following documents to pchub@latrobe.edu.au by **31 July 2026**:

- Application form completed
- Up-to-date CV
- University transcripts

Only shortlisted applicants will be contacted.