

An Indian-Australian research partnership

**Project Title:**

**Project Number**



**Monash Supervisor(s)**  *Full names and titles*

**Monash Primary Contact:**  *Email, phone*

**Monash Head of Department:**  *Full name, email*

**Monash Department:**  *Full name*

**Monash ADRT:**  *Full name, email*

**IITB Supervisor(s)**  *Full names and titles*

**IITB Primary Contact:**  *Email, phone*

**IITB Head of Department:**  *Name, Email,*

**IITB Department:**  *Full name*

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## Research Academy Themes:

**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](http://www.iitbmonash.org))*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. **Clean Energy**
4. Water
5. Nanotechnology

### **The research problem**

Decreased access to petrochemical reserves makes it necessary to switch to non-food lignocellulosic biomass as a renewable and sustainable resource. There exist several physical, chemical, and biochemical approaches for pretreating biomass, towards the efficient release of fermentable sugars. Most agricultural wastes and woody biomasses continue to show recalcitrance to current pretreatment approaches, and require significant utilization of enzymes, typically as fortified fungal supernatants, for complete hydrolysis to occur to sugar.

The use of ionic liquids (ILs) for pretreatment of biomass promises several advantages with greatly reduced biomass recalcitrance and enhanced enzymatic hydrolysis, consequently promising improved commercial feasibility of products such as cellulosic ethanol. It is proposed to evaluate various ionic liquids, using various chemical and physical characterization approaches, for their efficacy in enhancing cellulose hydrolysis. The cellulose hydrolysates generated would also be tested for fermentative production of products such as ethanol. It is also proposed to identify optimal process operating conditions, including IL recycle approaches such as nanofiltration.

From the experimental data generated for various IL systems, it is proposed to evaluate, from a computational perspective, whether there exist alternate, more optimal, solvents for improved hydrolysis.

### **Project aims**

*Define the aims of the project*

1. Identification of ILs, via an experimental screening approach, for efficient dissolution of biomass.
2. Evaluation of IL-treated hydrolysates for their fermentability.
3. Identification of optimal process and IL recycle approaches.
4. Development of computational approaches for rational selection of ionic liquids.

### **Expected outcomes**

*Highlight the expected outcomes of the project*

An optimized IL-pretreatment based process for the complete dissolution of various lignocellulosic biomasses.

### **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.*

1. Clean energy: Cellulosic ethanol is a renewable energy option of considerable current interest. Inexpensive biomass hydrolysis to sugars remains a major process hurdle. The results of this work are expected to directly address this problem.
2. Biotechnology: Sugar hydrolysates originating from lignocellulosic biomass would be a feedstock for production of fuels and platform chemicals, via various fermentative routes.

## 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.

M. Sc. or M. Tech. with a strong background in the life sciences, biotechnology, bioprocess engineering, or chemical engineering, with lab project experience involving microbiology, enzymology and molecular biology techniques. Familiarity with bioreactor operation is desirable but not essential.

## Additional costs and equipment

Describe below additional costs that would be needed to complete this project.

This would typically include project-related costs (such as consumables).

Computers, desks, conference travel, student travel to Australia, etc should not be included here. They are already provided for.

IF AMOUNT BEING SOUGHT IS IN EXCESS OF INR 3 lakhs OR \$6000, PLEASE COMPLETE FOLLOWING SECTION AS WELL

## Detailed justification - Additional costs and equipment

Please justify why is this level funding is required?

	INR/\$AUD	
What is the total funding required for the entire project?		(X)
How much bare minimum seed funding will be required to kick off the collaboration?		(Y)
What are the additional funds that will need to be sourced?		(X-Y)

How will the additional funds (X-Y) be sourced?

What happens if the PIs are unsuccessful in sourcing (X-Y) and we have a student selected?

Is there any industrial partner that might fund this project that we might approach?

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Please also fill up the Project Consumables Budget Excel spreadsheet template( available from The Academy) which is required for any budget request which is in excess of INR 3 lakhs OR \$6000.