

UQIDAR: The University of Queensland - IIT Delhi Academy of Research Joint PhD Project Proposal Template

1. Project Title:	Catalytic Conversion of Sugarcane Bagasse into Aromatics and High-Value Platform Chemicals
Project ID	UQIDAR-00115

2. Supervision Team

Please visit the IITD website www.iitd.ac.in and UQ Website <http://researchers.uq.edu.au/> to highlight potential collaborators that would be best suited for the proposed project. Complete where possible – advise if you'd like assistance establishing contacts.

	<i>University of Queensland</i>	<i>IIT Delhi</i>	<i>External/Industry (if applicable)</i>
Supervisor Name	<i>Prof. Robert Henry</i>	<i>Prof. K.K. Pant</i>	
School or Department (or company, if applicable)	<i>QAAFI</i>	<i>Chemical Engineering</i>	
Phone Number	<i>+61-7-3346 0552</i>	<i>+91-11-2659 6172/26596177</i>	
Email-ID	<i>robert.henry@uq.edu.au</i>	<i>kkpant@chemical.iitd.ac.in</i>	
URL for more info	<i>http://www.uq.edu.au/about/director-qaafi</i>	<i>http://web.iitd.ac.in/~kkpant/</i>	

3. Other Supervisor Details

Please include other associate supervisors below:

Full Name and Title(s):
School/Department/Company details:
Phone/Email/URL:

2. Field of Research CODES:

(Specify up to four four-digit FOR codes for your project – see [here](#) for more detail on FoR codes)

1. 0904	3. 0703
2. 1001	4. 0307

3. Keywords: (this will assist in classifying project and presenting projects to students on the applications portal)

Choose up to 4 keywords for your project.

Eg: nanotechnology, data science, novel batteries, etc

1. Catalysis	3. Biotechnology
2. Lignin Conversion	4. Biofuel

4. Discipline Background of Candidate: (this will assist in presenting projects to applicants on the apps portal)

Ideally this project requires students with a background in...

Eg: organic chemistry, physiology, topology, CFD, etc

1 Catalysis	3 Biomass Conversion
2	4. Lignin Conversion

5. Project description

Biomass offers considerable advantages in the form of bioenergy over conventional fossil fuels. It may be attributed to its renewability and carbon neutrality that makes it a source of cleaner fuel and high-value chemicals. However, it is worth noticing that majority of high-efficiency processes reported for value-added chemicals from bio-renewable resources have utilized biomass-derived molecules instead of direct utilization of lignocellulosic biomass due presence of binding material lignin. Therefore, lignin removal and its subsequent conversion in high-value chemicals are recommended prior to conversion of cellulose and hemicellulose. In general, conversion of lignin into useful products usually requires the presence of a metal catalyst for hydrogenation/hydrodeoxygenation reaction whereas conversion of cellulose and hemicellulose a combination of Lewis and Brønsted acid sites. However, lignin conversion is a challenging task owing to its complex and not well-known structure which makes screening and selection of catalysts difficult. Thus, an integrated approach to screen basic units in present in lignin followed by novel strategy for catalytic conversion of lignocellulosic biomass including lignin in platform chemicals such as HMF, Sorbitol, FDCA and lignin derived aromatics in the presence of metal-containing a multifunctional catalyst. In this regard, lignocellulosic biomass and lignin characterization methods will be developed under supervision of Prof. Robert Henry at QAAFI, QU, Australia. Subsequently, multifunctional catalysts will be developed under supervision of Prof. K.K. Pant for the conversion of lignocellulosic biomass and lignin into aromatics and platform chemicals such as 5 HMF, Sorbitol, FDCA. Since, India and Australia both are under top 10 sugarcane producing countries, thus development of sustainable technologies for lignocellulosic biomass sugarcane bagasse conversion will lead to development of futuristic biorefineries with zero waste approach. It is expected that successful completion and implementation of this project will affect 55 million Indian population positively who are directly or indirectly associated with sugar industries. As later part of this project, production of lignin rich sugarcane bagasse under supervision of Prof. Robert Henry will be undertaken if required.

6. Project deliverables/outcomes

The overall outcome would be a zero-waste sustainable technology for lignin and lignocellulosic biomass sugarcane bagasse conversion for immediate application in sugarcane industries worldwide. Nevertheless, there would be several direct and indirect deliverables/outcomes of the proposed project. Some of the major outcomes are as follows:

1. Standard protocol for lignin and biomass characterization
2. Novel catalysts materials for lignin and lignocellulosic biomass conversion
3. Technology for lignin and lignocellulosic biomass conversion
4. Standard protocol for lignin and lignocellulosic biomass derived products analysis

5. Techno-economic feasibility study of the developed process
6. Roadmap for conversion of other agricultural residues such as wheat crops residues, maize residues, etc.

7. Research Impact Themes:

Highlight which Research Impact Theme(s) this project will address?

(Feel free to nominate more than one. For more information, see <http://www.uq.edu.au/research/impact/>)

1. Healthy Ageing
2. Feeding the World
3. Resilient Environment
- 4. Technology for Tomorrow**
5. Transforming Societies

8. Type of Student

This project is best suited for an:

i-student	<input type="checkbox"/>
a-student	<input type="checkbox"/>
i- or a-student	<input checked="" type="checkbox"/> Both

Note that an i-student will be expected to spend year-1 at IIT-D, year-2 at UQ and the remaining time at IIT-D.

An a-student will spend year-1 at UQ, year-2 at IIT-D and the remaining time at UQ.

All students will be required to complete some amount of coursework in their first year.

9. Student capabilities and qualifications

List the ideal set of capabilities (at least 2 essential and 2 desirable) 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. Add specific skill sets here...

Essential Capabilities: Heterogenous catalysts synthesis and characterization for Biomass and Lignin Conversion

Desirable Capabilities: Experience in working on HPLC, GC-MS, FT-IR, Raman, NMR, BET, TPx, TGA, SEM, TEM

Expected qualifications (Courses/Degrees etc): M. Tech/M.S. in Chemical Engineering