IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Pectin Based films/gels for antibiotic/antifungal applications**	
Project Number	**IMURA0822**	
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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

Define the problem

Previous work undertaken by PhD students (J. Bannerjee, S. Talekar) has established green and efficient methods for extraction of pectin from a number of fruit waste sources (eg mango, pomegranate). Numerous recent studies have shown that pectin can form gels and films with excellent oxygen and water barrier properties, and this was subsequently verified in current work at IITB-Monash. The incorporation of antibiotic and antifungal properties into these films has received less attention and is an opportunity for further innovative research.

Food quality and safety are major concerns in the food industry as consumers prefer fresher and minimally processed products. In particular, bacterial contamination of ready to eat products constitutes one of the most serious health hazards to human population. Antibacterial sprays or dips have been formulated to overcome many such contaminations

Pectin contains both free carboxylic acids and methyl ester groups. The degree of methylation varies with pectin sources and can also be controlled under mild extraction conditions. These functional groups can interact with metal ions and other polar molecules and complexes, affecting the gelling properties and ultimate stability of the gels. Bismuth compounds (Andrews et al) have been shown to possess antibiotic and antifungal properties. Incorporating these into pectin gels made from a variety of carbohydrates, including medical grade honey offer great potential.

This project will explore the synthesis and properties of a range of gels and films, focusing on pectin, composites with other carbohydrates and incorporating antibiotic/antifungal agents into these materials. Antibiotic and antifungal efficacy will be investigated. Possible uses include wound dressings and the development of biodegradable and edible "dip" coatings to extend fruit shelf life.

Project aims

Define the aims of the project

1. To develop and characterize physicochemical properties of pectin-Bismuth based single and composite films for specific applications.
2. The antibacterial activity will be evaluated on pathogenic bacteria such as *Escherichia coli*, *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas*, and *Candida albicans*.
3. Optimization of thickness, water vapor permeability, opacity, and mechanical properties of the films based on end use application.
4. Techno-economic feasibility analysis of the developed product/s.

Expected outcomes

Highlight the expected outcomes of the project

1. Development of a novel process/method to form a stable pectin-Bismuth compounds based gels/films for F&V shelf life preservation and other applications.
2. Through proper information dissemination, it is expected that the project outputs will increase interest and investment from potential stake holders (Farmers, consumers, food and chemical industries, state and central governments).
3. New commercial opportunities to valorise food by-products
4. Postgraduate training and graduates with experience to work in food valorisation and future Food processing preservation employment opportunities

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.

This project covers Green Chemistry (green processes for pectin extraction), Food (for packaging application), Pharmaceuticals (antimicrobial activity) and potentially, Biotechnology (enzyme processing may be applied), and Nanotechnology (applications in food packaging and wound dressing)

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.

Applicants should have at least a four-year degree in Chemistry/Food Science/Biotechnology/ Chemical Engineering/Material Science with first class honours or equivalent (Master's degree is preferred). This project requires strong understanding of Carbohydrate chemistry and organic transformations, biochemistry and biochemical engineering principles. 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.

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, Nanotechnology, Green Chemistry, Food Innovation