IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	Microfluidic route to generation of core-shell fibers for drug delivery	
Project Number	**IMURA0750**	
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Research Clusters:

Highlight which of the Academy's CLUSTERS this project will address? *(Please nominate JUST **one.** For more information, see www.iitbmonash.org)*	
1	***Material Science/Engineering (including Nano, Metallurgy)***
2	*Energy, Green Chem, Chemistry, Catalysis, Reaction Eng*
3	*Math, CFD, Modelling, Manufacturing*
4	*CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control*
5	*Earth Sciences and Civil Engineering (Geo, Water, Climate)*
6	*Bio, Stem Cells, Bio Chem, Pharma, Food*
7	*Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng*
8	*HSS, Design, Management*

Research 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)*	
1	*Advanced computational engineering, simulation and manufacture*
2	*Infrastructure Engineering*
3	*Clean Energy*
4	*Water*
5	***Nanotechnology***
6	***Biotechnology and Stem Cell Research***
7	*Humanities and social sciences*
8	Design

The research problem

Encapsulation of drugs, cells, and other therapeutic agents into biomaterials such as microcapsules, micro and nano fibers, has wide ranging applications in the fields of drug delivery and tissue engineering. Microfluidics through its ability for precise control has shown to be a robust platform for generation of these materials. In this project, a solvent-removal based fiber generation technique will be implemented on a microfluidic platform for generation of core-shell micro fibers. The core is targeted to be aqueous based and the shell a bio-compatible polymer, allowing for drug delivery applications. Control over the fiber properties, encapsulation efficiency of the approach, viability studies on encapsulated cells and release kinetics of loaded drugs will be investigated in this project.

Project aims

The specific aims of the project include:

1) Design and development of a microfluidic device for generation of aqueous core - polymer shell microfibers;

2) Investigate the effect of flow parameters on the core size and shell thickness;

3) Encapsulation of cells into the liquid core and viability studies;

4) Release kinetics studies of drugs loaded into the aqueous core and polymer shell

Expected outcomes

The expected outcomes of the project include:

1) A novel robust microfluidic platform for generation of core-shell microfibers

2) Control over the fiber properties through operating parameters

3) Ability to produce intact liquid core in fibers, a challenge in many existing approaches

4) Ability to encapsulate multiple kinds of cells, both in the core and the shell.

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

The proposed project will extensively use nanofabrication techniques for making of the microfluidic devices and hance will fall the “Nanotechnology” theme. In addition, the

project will achieve successful encapsulation of cells into polymeric materials and hence falls under the theme of “Biotechnology’.

Capabilities and Degrees Required

The student should have an engineering background with good experimental skills and interest in developing/exploring novel designs of devices for application-based microfluidics is required. Any prior exposure to biotechnology is a plus.

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.

Novel functional materials;
Nanotechnology, nanoscience;
Bioscience, Biomedical engineering;
Materials Chemistry/Science;