IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

Project Title:	**Soluble Polymer Supports for Peptide Synthesis**	
Project Number	**IMURA0797**	
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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

There is a growing need for synthesizing peptides in an industrial scale due to their applications in the area of pharmaceuticals and bio-sensors. Peptide synthesis was predominantly carried out in solution prior to the development of solid phase peptide synthesis (SPPS) by Merrifield. Currently, automated peptide synthesizers are efficiently utilized to synthesize oligopeptides in μM – mM scale. Scale-up of SPPS has been recently achieved using continuous flow based techniques. However, large excess of amino acids and coupling reagents (3-6 equiv or more) are typically required to drive these reactions because the reaction medium is heterogeneous. Polymer supports that are soluble in the reaction medium do not require excess reagents to drive the reactions to completion. Further, utilizing flow-based techniques to carry out peptide synthesis would make this methodology scalable, cost-effective and attractive for industrial use.

Project aims

The major objective of the project is the development of soluble polymer supports for scalable and cost-effective peptide synthesis. Supports derived from non-crosslinked polymers decorated with solubilizing groups and sites for growing peptides will be synthesized at IITB. The efficiency of these supports for peptide synthesis will be assessed using conventional batch-type reactions. This approach will be greener than conventional solid phase peptide synthesis. At Monash, efforts will be focused on using flow synthesis and online reaction monitoring to make this methodology scalable and automated.

Expected outcomes

The major outcome of this project will be developing a greener and cost-effective method for peptide synthesis. The use of soluble supports coupled with flow chemistry will make this method scalable. Currently, automated solid phase peptide synthesis is most convenient for peptide synthesis despite the large wastage of reagents during this process. A competing method using soluble supports that is scalable and can be potentially automated provides a much greener alternative for peptide synthesis. Several high-impact publications and eventually patent applications can be expected from thesis work in this field.

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

Great emphasis has been placed on the use of bioinspired materials for the development of nanoscale devices. The base pairing in DNA as well as the hydrogen-bonding between amino acids in peptides have been exploited for device fabrication. However, the growth of peptide nanotechnology has been slower than DNA nanotechnology despite the fact that peptide chemistry has a larger repository of building blocks compared to DNA. Greener and cost-effective methods to synthesize peptides could bridge this gap and make peptides for nanotechnological applications much more accessible.

Capabilities and Degrees Required

-knowledge in organic chemical synthesis
-base knowledge on contemporary polymer chemistry
--basic knowledge on biomolecules

Potential Collaborators

Further collaborators at IITB and Monash University will be sought should the project require this.

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.

Green Chemistry and Renewable Energy
Catalysis and Reaction Engineering
Bio Chemistry