### Research Theme: Drug discovery, Isolation and Characterization of Natural Products

### Research Project Title: Large-scale conversion of wastes to functional food and high-value products

**Principal Investigator/Supervisor:** Prof James P Tam  
**Co-supervisor/ Collaborator(s) (if any):** NA

## Project Description

### Background

Coffee pulp and husk are by-products of coffee beans during coffee productions. By weight, they account for nearly 50% of the harvested coffee beans. But they are considered wastes and have not found much uses except for hauling back into the fields as a low-grade fertilizer. Furthermore, their high tannin content prevents them from being used extensively in animal feeds. They also constitute a serious source of pollutant that poses environmental concerns. Thus, there is a great interest and an urgent need to convert the coffee wastes into value-added products and other commercial applications.

Recently, our laboratory has isolated and characterized a family of highly promising pharmacologically active peptides, coffeetides, from the coffee pulp and husk. We have shown that coffeetides are metabolically stable and able to modulate cardiovascular functions. We were successful in characterizing their sequences, determining their structures, and confirming their pharmacological functions. However, we are unable to disclose detailed information in this application while we are preparing for a patenting process.

Cardiovascular diseases are the leading health issues and the underlying the cause of hypertension and stroke which affect disproportionately the ageing population. Importantly, coffeetides share similar structure and functions to a family of peptides which we have isolated in ginseng, a highly medicinally valued herb, and from cocoa powder which are widely consumed worldwide. Our findings offer a unique opportunity to transform waste materials in coffee production into valuable and functional-food compounds.

### Proposed work

We propose to use membrane technology which includes ultrafiltration and nanofiltration for the isolating biologically active peptides from the coffee by-products. Our long-term goal also aims to exploit membrane processing technology to detoxify the coffee pulp and husk by making them suitable for animal feed, fertilizer and compost.

Membrane technology with selective transport and high separation efficiency has an advantage over conventional methods using chromatographic separation. In addition, membrane units are modular, and the process is amenable to be scaled up for kilo-ton production, a requirement for a successful venture of such a process. It can also be coupled to other processes such as adsorption, reaction and ion exchange chromatography to further increase the separation efficiency to achieve the desired results.

We are fortunate to have collaborators who are experts to meet these challenges. They include Professor Rong Wang and the Development Team at the Singapore Membrane Technology Centre (SMTC). They have expertise in membrane fabrication and modification, process design, optimization and fouling control in both water treatment and food industry.
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