Business Interaction Vouchers Round 1 (January 2020)

Purification and characterisation of Sophorolipids using Supercritical CO_2	
Lead applicant's name	**Dr Rob Elias**
University/ research institute	**Biocomposites centre, Bangor University**
Industrial partner	**Dr James Winterburn**
Company	**Holiferm**

PROJECT ABSTRACT:

Sophorolipids are a class of glycolipid biosurfactant produced by yeast fermentation that can be used to replace petrochemical derived surfactants and help to replace the use of palm kernel oil. Holiferm has optimised the fermentation system through the development of new process techniques but the fermentation still results in a complex mixture of sophorolipids of varying chemical structure and differing physical properties, making formulation of end products complex. This project will fully characterise the sophorolipid mixture that is produced and will use supercritical CO_2 fractionation techniques in an attempt to separate the different groups of sophorolipids namely those that are in the cyclic (lactonic) form and those in the open chain (acidic) form as well as additional separation linked to the degree of acetylation. The supercritical CO_2 group at Bangor University has previously worked with other types of biosurfactants and have demonstrated that separation of closely related molecules (also glycolipids) such as Mannose Erythritol Lipids (MELs) and Rhamnolipids is possible based on the degree of acetylation and number of sugar molecules present, but has not previously attempted the separation of cyclic and open chain forms such as those found in sophorolipid mixtures. If this fractionation can be achieved it will open new opportunities for unique formulations using sophorolipids with a defined molecular structure and physical properties and produce high value biosurfactants from a crude fermentation mixture. In addition, through analysing the fermentation products, we will gain an insight into how yeast fermentation might be manipulated to produce specific biosurfactant molecules.

RESULTS REPORTED:

Crude characterisation of complex mixtures of sophorolipid biosurfactants produced by yeast fermentation has been carried out using GCMS. The complex mixtures have been extracted, based on existing literature, using sub-/supa-critical CO2 creating four fractions. The fractions have been partially characterised using GCMS giving a greater understanding of the biosurfactant molecules present in the mixture. An improved characterisation technique is in development for a greater accuracy analysis of sophorolipid fractions using LC-HRAM-MS accompanied with the collection of data to produce a new specific sophorolipid MS library.

Development of a cell-free strategy for directed evolution of enzymes for high-value natural products	
Lead applicant's name	**Dr Simon Moore**
University/ research institute	**University of Kent**
Industrial partner	**Dr Matthew Hodges**
Company	**Oxford Biotrans**

PROJECT ABSTRACT:

Synthetic biology can be described as the next major frontier in engineering since the industrial revolution for developing green and biofriendly processes to replace organic chemistry. In this project, we are seeking to understand how we can use synthetic biology to increase our capability to produce difficult to make high-value chemicals such as fragrances and fine chemicals. To do this, we are using a bacterial "cell-free system", which literally means taking the guts of a living cell and then using it to kick-start life inside a test-tube. This is equivalent to organic chemistry but without the need for high-temperatures and toxic metal catalysts. The final outcome of this project will develop green technology that is expandable and beneficial for a range for high-value chemicals of industrial interest within the UK.

RESULTS REPORTED:

This project aimed to study how we can awaken biological systems outside of a living cell – we call this area cell-free synthetic biology. Specifically, we investigated how we could create a cell-free enzyme pathway to make haem inside a test tube. Haem is a member of the tetrapyrrole family (e.g., chlorophyll, phycobilins), which are collectively referred to as "pigments of life". From this project, we have activated a complex enzyme pathway to make the final precursor before haem. Further steps will attempt to make haem in a test-tube and then use it for different applications within industrial biotechnology, such as the production of fine chemicals and medicinal drugs.