Business Interaction Vouchers Round 6 (July 2021)

Immobilising enzymes on mesoporous carbonaceous materials for potential application in carbon capture	
Lead applicant's name	James Clark
University/ research institute	University of York
Industrial partner	Jacqueline Hollands
Company	Merck

Project abstract: Microwave processing of solid waste results in the production of a highly calorific residues, syngas and an acidic bio-oil. This conversion has been demonstrated on a number of bio-derived feedstocks and is well established within a bio-refinery concept. The highly acidic oils currently produced only have applications if the system employed is sufficiently selective towards a single product (through use of catalysis, solvents and reagents) e.g. production of levoglucosenone or levulinic acid. Here this project would examine the utility of inclusion of the red alga extremophile Galdieria sulphuraria subsequent to microwave processing. This heat and acid tolerant alga is capable of versatile metabolism and is a perfect candidate for bioconversion of mixed waste streams. Both the residue and the oil can be used as a food source for the alga resulting in heavy elements, such as metals, being enriched in the former and converting an acidic product to a lignin-free feedstock for the latter. Galdieria has already been shown to bioaccumulate precious metals, such as gold and silver, as well as rare-earth metals. Of real excitement is the opportunity to combine waste biomass with non-recyclable plastics (black plastics which would be excellent microwave absorbers, as well as mixed plastic/multi component systems) and electronic waste to take previously un-recyclable and/or non-degradable waste and use microwave technology to make it bio-available. The alga grown on the oils and residues would then be harvested separating the metals (catalysis), polysaccharides (materials), sugars and proteins (secondary fermentation), as well as more intensive separation of small volume, high value antioxidants (additives).

Browser-based comparative analysis of industrial fermentations	
Lead applicant's name	Gavin Thomas
University/ research institute	University of York
Industrial partner	Matthew Hodges
Company	Oxford Biotrans

Project abstract: MORF is a web-based platform, developed at the University of York, for storing, sharing, and interrogating data for industrial biotechnology. It integrates multi-omics data from fermentation experiments with microbial genomes, allowing bench scientists to perform complex data analysis through their browser. MORF has the potential to play a major role in supporting the development of new strains of organisms and new biological processes towards improved biomanufacturing.

Oxford Biotrans (OB) uses cytochrome P450 enzymes to produce high-value specialty chemicals. Their main experimental program comprises highly monitored industrial fermentations. OB would like to use MORF to store and explore existing and future fermentation and subsequent transcriptomic data, to improve their bioprocess. As an SME with experienced experimental scientists but not a dedicated bioinformatics team, they are an ideal company to benefit from MORF.

This BIV will support the creation of a secure OB MORF site that will initially focus on the storage and presentation of fermentation data for analysis by their scientists – a key data type in industrial biotechnology, regularly stored in Excel. While basic features for displaying fermentation data exist, the complex accompanying metadata measuring process parameters during the experiment will need expansion of MORF capabilities. Most importantly we will create new tools using machine learning for direct comparison of fermentation runs, allowing OB scientists to assess parameters that correlate with improved productivity. The developed tools will also then be available in MORF, which is being commercialised by the Thomas group, and will be a valuable resource for the IB sector.