Business Interaction Voucher Awards 2015

**Process improvement feasibility study**
Award Holder: Keith Waldron, IFR
Industrial Partner: CelluComp Ltd

**Project Outcome Public Summary**

CelluComp Ltd. working with The Institute of Food Research through a FoodWasteNet Innovation voucher have successfully investigated the potential for improving CelluComp Ltd’s manufacturing process through exploiting IFR’s expertise on the sequential extraction of plant cell walls, in the context of CelluComp Ltd’s scale-up expertise and process chain development.

**Safe and efficient movement of bulk material in bio-bean Ltd’s Alconbury processing facility**
Award Holder: Michael Bradley, University of Greenwich
Industrial Partner: bio-bean Ltd

**Project Outcome Public Summary**

The preliminary study indicates that aeration of the wet, granular biomass at low flow rates (to avoid cooling) can support a degree of self-heating resulting in loss of a quarter to a third of the moisture content (on a wet basis). It is anticipated that in a larger scale installation, the self-heating and the consequent drying will probably be more effective. The moisture reduction would make a significant saving in conventional drying costs and handling - probably by a third, possibly more. The results in hand will allow a first stage evaluation of cost-effectiveness of this principle of drying.

**Conversion of waste bread from sandwich industries to bioethanol by thermophilic bacteria capable of utilizing oligomeric sugars**
Award Holder: David Leak, University of Bath
Industrial Partner: Greencore Prepared Foods

**Project Outcome Public Summary**

Greencore, a major sandwich producer in the UK provided 10kg of mixed bread crusts from 2 of its UK plants. The industrial amyloytic thermophile Geobacillus strain TM333 from ReBio LTD was used to produce the enzyme alpha amylase on various media (glucose, starch or waste bread crusts) and also used in the fermentation of waste bread, or the enzyme used to generate sugars for subsequent yeast fermentation. A bacterial thermostable alpha-amylase is traditionally used with starch based feedstocks to cleave the alpha 1,4 glucan linkages that make up the backbone of the starch polymer. This breaks the starch (insoluble amylopectins) into smaller oligomeric fragments that are water soluble (dextrins). Glucoamylase (also called amyloglucosidase AMG) is an additional enzyme traditionally added to break the starch and dextrins generated by alpha amylase into glucose through a stepwise hydrolysis of glucose from the end of the molecules, generating fermentable sugars (glucose).
Various processing regimes were used to show the superiority of TM333 over a commercial C5 yeast strain (DSM) in fermenting waste bread with or without enzyme and/or heat treatment and also in a Consolidated Bioprocess (CBP). The latter showed that TM333 can be used to directly ferment waste bread without any heat treatment or enzyme supplementation. The use of alpha amylase produced by TM333 and further saccharification with glucoamylase was necessary to allow the yeast to effectively ferment all the sugars in waste bread. Both yeast and Geobacillus fermented the carbohydrate in the waste bread to ethanol with 100% yield equating to 45-46.7g ethanol per 100g of waste bread depending on the treatment. The success of waste bread CBP with TM333 can be attributed to the alpha amylase thermotolerance and activity over a wide range of pH, which allows the SSF and CBP to be conducted at pH 5.5/30°C or pH 7.0/60°C for yeast and Geobacillus respectively, with concomitant high ethanol yields at 24hr (yeast) and 48hr (Geobacillus). The remaining solids after fermentation are rich in microbial protein, making them a candidate as a high value animal feed.

**Extraction of polyphenolic compounds from blackcurrant skins**

*Award Holder:* Paula Jauregi, University of Reading  
*Industrial Partner:* A&R House (BCL) Ltd

**Project Outcome Public Summary**

About 700,000 tonnes of black currants are processed to juice and other products in EU each year. This results in a large amount of waste material (about 10-20% berry weight) which needs to be disposed (often used for animal feed). However it is a rich source of antioxidants which can be used in food, pharmaceutical and cosmetics applications. The aim of this study was, in partnership with a UK company that processes blackcurrant skins, to develop an improved extraction method to recover antioxidant compounds from this waste product. We have been successful in extracting polyphenols in high yields and with antioxidant activity. Further studies are required to investigate the scalability of this process and the application of the extracts for example, as food colourants (due to their high content in anthocyanins which are responsible for the colour) and in cosmetic products (due to their antioxidant activity).

**Assessment of the viability of production of flavour products from waste allium process streams using supercritical fluid extraction methods**

*Award Holder:* Ray Marriott, Bangor University  
*Industrial Partner:* William Jackson Food Group

**Project Outcome Public Summary**

The aim of this project was to valorise a food process waste stream and the flavour compounds found in the waste allium have been identified as a potential source of valuable flavour chemicals for the use as a food ingredient. In this project, we have examined two sources of waste allium (onion and garlic) and have demonstrated the application of scCO₂ to extract flavour compounds from these waste streams was feasible. Our findings conclude that an array of thiol based compounds can be extracted from garlic waste and the extract obtained had demonstrated it can be potentially a source of flavour compounds that can be utilised as a food ingredient.

In the study, the optimisation of the process and the examination of the impact compounds were not fully evaluated and it is intended that we will seek further collaborative funding to expand the scope of this very promising study.