FoodBioSystems DTP - PhD Project Advertisement

Project title:

FBS2021-19-Bryant: Biorefining Protein from UK Grasslands – Can We Combine Novel Protein with Surplus Bread Crusts to Sustainably Feed Healthier Food to More People?

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This CASE industrial studentship will develop industrial biotechnological fermentation processes to deliver sustainable food manufacturing of the future. By using microbial phenotyping (Omnilog Biolog), pilot-scale biorefining and fermentation technology, forage protein extracts and surplus bead crusts will be combined and transformed to produce a sustainable health food. The studentship will be supported by industrial placement at Samworth Brothers Ltd Revolution Kitchen and industrial microbiology laboratory.

Project description:
The Biorefining Centre of Excellence at Aberystwyth University, together with the Department of Food and Nutritional Sciences at Reading University and Samworth Brothers Ltd have combined to offer an exciting and challenging project that will utilize microbial/fermentation/extraction and downstream processing technologies at pilot scale, at the Aberystwyth Innovation and Enterprise Campus ('AberInnovation'), together with formulation analysis and tasting panels to produce a healthy sustainable food.

The hypothesis to be tested in this studentship is: Protein-rich juice extracted from forage grass/clover combined with surplus bread crusts can undergo bioconversion by mixed microbial consortia producing a safe, sustainable, novel human food ingredient from grasslands (fig1).

The objectives of this studentship are:
1) Optimisation of extraction, concentration and purification of grass/clover juice rich in protein and nutraceuticals (fructans, phytoeostrogens and pinitol).
2) Development of a biorefining process for protein-rich juice through solid-state fermentation, using excess bread crusts as a scaffold (laboratory and pilot plant scale).
3) Characterisation of the nutritional composition, flavour profile, sensorial and technological properties of the final product and correlate factors of the biorefining process and development of these properties in order to modify the

process and optimise the final product.
4) Final product modification through processing operations to develop specific technological functionalities for use in food model systems.

British grassland farming covers 72% (12.6 million ha) of the utilised agricultural area, supporting 9.7 and 34 million cattle and sheep respectively. Coupled with the drive towards zero-carbon 2040, diversification away from livestock production and plant-protein imports (e.g. Soya and other pulses) to alternative on-shore grown plant-protein fit for human consumption may provide longer-term environmentally beneficial economic security for UK farmers.
The opportunity for plant-protein production on an existing agricultural level exists within the UK. Forage grass (Loillium/Festuca spp.) are known to contain up to 10% crude protein while clover (Trifolium spp.) contain up to 20%. Additionally, Samworth Brothers Ltd (SBL) are a leading UK sandwich provider; producing 30-50 tonnes per week of excess bread crusts from their manufacturing operations whose disposal route is as animal feed. Using plant-protein from UK grown crops to keep this bread in the human food chain is a future aspiration of Samworth Brothers.
The development of new protein-rich ingredients involves many challenges to the food industry as the product must have a high nutritional value (amino acid profile and digestibility), no allergenicity, adequate technological properties (e.g. solubility, foamability etc.), acceptable flavour and mouthfeel (astringency). Through co-fermentation anti-nutritional factors can be degraded, protein structures are developed, and other metabolites (vit B12) and flavours (umami) are produced; thus, controlling the substrate, organism and process could help develop a novel biorefining process producing high quality vegetable protein-rich food product(s).

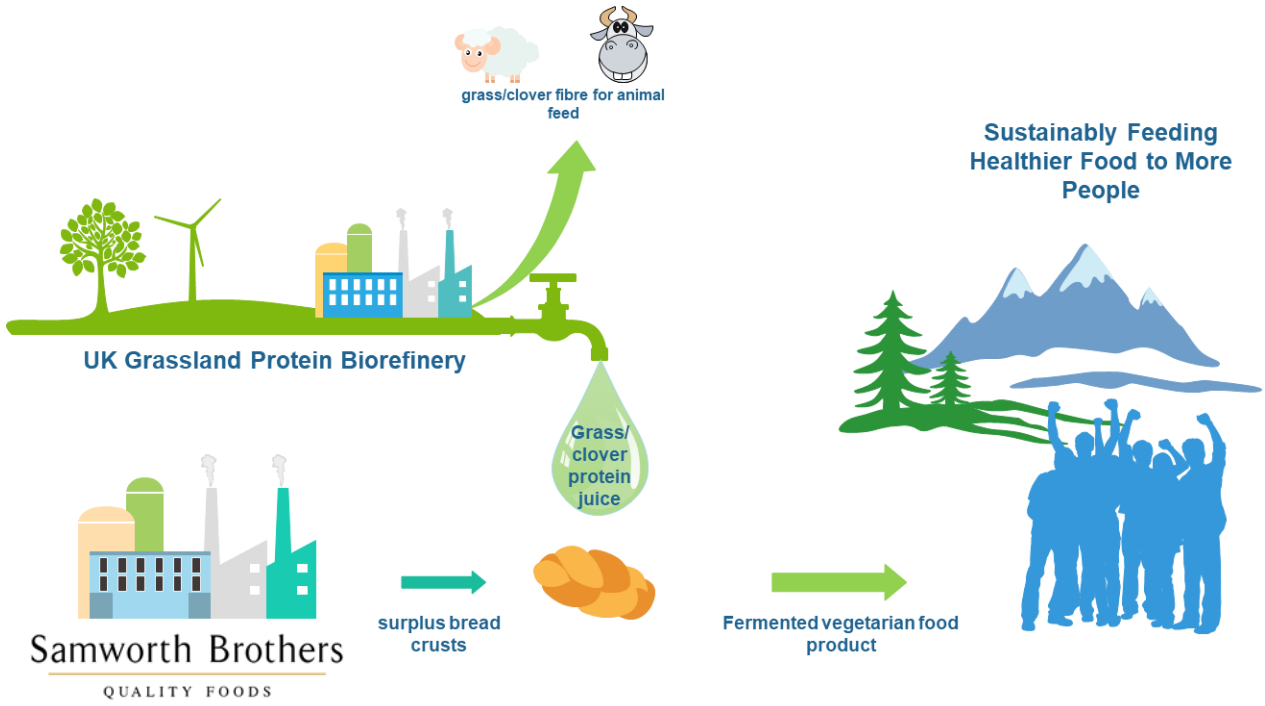

Figure 1. Developing alternative protein-based, fermented food products from grasslands and surplus bread that are nutritious and attractive to consumers.

Training opportunities:
The successful candidate will undergo interdisciplinary training in grassland science, microbial phenotyping (Biolog Omnilog located in the new AberInnovation facilities), fermentation and food science to investigate novel protein and carbohydrate bioconversion in fermented food. University of Reading (UoR) will support the candidate to gain expertise in food physics (rheology, microscopy), food processing (dehydration and extrusion), flavour chemistry (GCMS, GC-O), and sensory science (trained consumer panel and evaluation facilities). The candidate will be trained in using world-class state-of-the-art pilot-scale food manufacture and biorefining capability and be supported by expertise in statistical design

of experiments (DoE) and analytical chemistry.

The CASE studentship offers the opportunity of placement with the industrial co-sponsor Samworth Brothers Ltd, a food manufacturing business with 15 sites across the UK turning over c. £ 1billion / annum, with 'own label' and retail brand products sold through the major multiple retailers. Categories supplied are Sandwiches, Ready Meals, Salads, Pies, Pastry and Desserts and brands include Ginsters, Soreen, Sci-mx Sports Nutrition and the West Cornish Pasty Company. Samworth Brothers are keen to develop the students understanding of the food manufacturing industry through placements at a site level with training on ingredients and processing and additionally at the group microbiology laboratory where the safety of our products are tested on an industrial level. The input of Samworth Brothers team of scientists, technologists and manufacturing colleagues can be supplemented by the extensive network of suppliers with specific expertise at an ingredient level offering the candidate an opportunity to see how the business operates and how they establish and work with supply chains from raw ingredients to distribution.

Student profile:
Applicants should hold, or expect to obtain, a first or upper-second class honors degree, or a Master's degree (or equivalent) in Plant Science, Microbiology, Food Science Bio/Chemistry or related subjects. Applicants with practical experience in microbiology, nutrition, chemical engineering and statistics are particularly welcome. An interest in food biotechnology and an understanding of the challenges facing the Agri-Food sector in sustainably meeting the nutritional needs of an ever-expanding population are desirable, as are experience of presenting and publishing.

AU is a Bilingual Institution which complies with the Welsh Language Standards and is committed to Equal Opportunities. Students are welcome to apply in Welsh or English and any application submitted will be treated equally.

Funding particulars:
This CASE studentship is co-sponsored with Samworth Brothers Ltd and includes additional funding covering £2000 per annum increase to the stipend and a generous travel and accommodation budget for the industrial placement.
This project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants.
The studentship is open to UK and international students (including EU countries) however due to funding rules, no more than 30% of the projects can be allocated to international students.
The funding will include a tax free stipend (minimum £15, 285 per year), support for tuition fees at the standard UK rate (currently £4,407 per year) and a contribution towards research costs. **Please note** that the host universities have not yet confirmed the level of fees charged to international students funded by the DTP. Fee levels may vary across the institutions. This information will be shared on the FoodBioSystems DTP website as soon as it becomes available.

To apply
Please go to FoodBioSystems DTP website for information on how to apply for this studentship. The closing date for applications will be 8 February 2021.