PhD Project Advertisement

Project title: ***SALTernatives from seaweed: salt reduction in foods through seaweed extracts***
Project No: FBS25-60-Adams-ab

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Project description: Excessive sodium-based salt (NaCl) intake in the diet increases blood pressure and the risk of developing heart disease and strokes. In certain foods, however, NaCl can be partially or wholly exchanged with potassium-based salt (KCl) which is not linked to these negative attributes, whilst maintaining the flavour and preservation aspects within the food. Seaweeds contain high concentrations of non-sodium, salt-forming elements, particularly potassium, magnesium and calcium; these can be extracted and concentrated from seaweed washes to create low-sodium salts. Seaweeds are also rich in the flavour-enhancing soluble amino-acids glutamate, aspartate and alanine, providing odour-induced taste enhancement and 'umami'-flavours, with free 5'-monophosphate nucleotides also contributing to the perceived end-taste. These can also be isolated and used to reduce total salt demand in foods.

Project aim: Salts, amino-acids and 5'ribonucleotides from seaweeds will be optimally isolated, purified and used; creating viability-assessed, novel, low-sodium salt and flavour enhancer products which can reduce the sodium content in foods without negatively affecting taste.

The aim will be achieved through four, interlocking objectives.

1) Seaweed salt, aminoacid and 5'ribonucleotide extract potential

Seaweeds will be collected at Aberystwyth and used to produce a wide range of seaweed solutions which will then be filtered through a combination of membranes under pressure to optimise each fraction of interest. The elemental composition and quantification of the salts, amino acids and ribonucleotides will be determined using analytical equipment (primarily liquid/gas chromatography and mass spectroscopy) with volatile aroma profiles also assessed.

2) Commercial seaweed wash potential

Seaweed wash and liquid fractions will be provided from seaweed processing company MBL to determine what salts, aminoacids and ribonucleotides can be extracted from commercial waste streams.

3) Purification, scaleup and food inclusion

Optimised extraction of selected fractions will be produced at pilot-scale using the food-grade facility based at Aberystwyth, then used as food ingredients with consumer trials at Reading. Cutting-edge food science methods will be used to assess products' physico-chemical and structural properties (volume, texture), flavour and colour profile, and sensory quality.

4) Techno-economic (TEA) and life cycle assessment (LCA) analysis

TEA and LCA will be carried out throughout Obj.1-3 to determine the environmental performances of the extracts, from processing design (i.e. upstream); and from a whole supply chain perspective (including downstream). The project will calculate carbon footprint and energy demand with simulation software used to determine CAPEX and OPEX.

Training opportunities: The successful applicant will be based at Aberystwyth where they will gain key extraction and analytical techniques including membrane filtration, HPLC and MS. In year 2, the student will produce extracts at scale in AU's food-grade pilot-scale facility. They will also complete requisite post-graduate training in addition to professional development and external courses. In year2-3, the student will have a placement at Reading over 3-months, receiving training in the design and implementation of new product development trials and sensory trials in their Food Processing and Sensory Science Centres, alongside further analytical training for tastants and flavour analysis. Brunel will provide training in LCA methodology, techno-economic evaluation and simulation techniques including commercial software training, through online and in-person contact. Experience of a commercial seaweed biorefinery including access for LCA data collection is a further, unique opportunity within this PhD project.

Project supervision style: The student will meet with the principal supervisor at least weekly in-person, with a monthly meeting documented to assess progress, problems, training requirements and forthcoming events. They will also be invited to attend in-person weekly research and lab group meetings. A monthly online meeting with all supervisors will be scheduled for updates and project discussion across the supervisory team; individual meetings and planning meetings will also occur with the relevant supervisors as required.

Stipend (Salary):
FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2024/25 this is £19,237 (£21,237 at Brunel University) and it will increase slightly each year at rate set by UKRI.

Equity Diversity and Inclusion:
The FoodBioSystems DTP is committed to equity, diversity and inclusion (EDI), to building a doctoral researcher(DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the FoodBioSystems DTP website and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- Guaranteed interview and applicant mentoring schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups.

These are opt-in processes**.**

Our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

For up to date information on funding eligibility, studentship rates and part time registration, please visit the FoodBioSystems website.