PhD Studentship: Novel, disruptive solutions for improved valorisation and pasteurisation for anaerobic digestion (AD) of food waste (FW) collected by centralised retail food waste management companies

University College / Management Unit	College of Health and Agricultural Science
University School / Unit	School of Agriculture and Food Science
Post title	PhD
Project title	Novel, disruptive solutions for improved anaerobic digestion (AD) of food waste (FW) for the production of biomethane and other value added products
Post duration	4 years
Supervisors / Mentors	Prof James Lyng and Dr Ajay Menon
Main location for project	UCD
Provisional start date	01/09/2024
BiOrbic Challenge alignment	Food Waste Prevention & Valorisation
Salary	€22,000 tax free per annum plus university fees

Summary

The overarching aim is to explore the potential for novel technological interventions at various points in the anaerobic digestion process, either as pretreatments (to enhance matrix performance, bioavailability and community dynamics in AD), post treatments (to decontaminate or upgrade effluent in a more efficient fashion) or as interventions during anaerobic digestion (to stimulate the fermentation process). It is envisaged that these interventions will significantly improve yields while removing the capital and operation costs of AD plants. This would democratise the AD platform as a solution for biomass valorisation by bringing it within the reach of smaller and decentralised operators. The project will also aim to explore novel technologies for post-pasteurisation in existing AD plants using mixed biomass/waste sources which can dewater the digestate and render it into a high value material for peat free horticultural growth medium.

Tailoring a FW pre-treatment process using novel technologies could improve biogas production and pasteurise FW by inactivating competing microorganisms. This will maximise the biogas potential of FW, minimise methane loss/emissions in transport to AD plants and remove the need for post-AD pasteurisation for plants using substrate made by this process. This aligns with national and EU goals of energy security, net zero transition and green growth.

Creating a post-treatment suite of processes centred on novel technological interventions would make digestate treatment financially viable for AD plants using mixed substrates and improve dewatering of effluent to produce a solid cake. The solid cake from the above process could be used

as a growth medium for horticulture nurseries, thus eliminating a) land spread of digestate b) creating a locally produced high value fertiliser/growth medium c) reduce imports of peat.

The PhD candidate will also be working on the life cycle assessment and technoeconomic modelling of these processes which will involve liaising and collaborating with other projects within BiOrbic.

Objectives

1. To demonstrate effectiveness of food waste pretreatments prior to AD
2. To demonstrate the effectiveness of novel processing technologies as posttreatments for upgrading digestate as a feedstock for downstream processes
3. To demonstrate the effectiveness of novel technological interventions to enhance the yield and rate of biogas production during AD.
4. Process optimisation; To optimise novel technological interventions for 1-3 above and demonstrate technological interventions at a higher TRL level
5. To explore the potential for novel technological interventions for dewatering AD digestate into a peat alternative solid fertiliser or growth medium
6. The expected output of the PhD would be 3-4 high impact publications, along with contributions to publications from partner groups, conference presentations and potential IP from the developed technologies.

Requirements

A 2.1 or 1.1 degree at undergraduate level in Biotechnology, Environmental Sciences, Chemical Engineering, Food Chemistry, Food Science, Food Technology or a related discipline that has relevance to the aforementioned activities is essential. A relevant masters degree is desirable.

Knowledge, skills, experience

The successful candidate will be self-motivated with experience in working on research projects and will have: -

- Knowledge of processing technologies
- Interest in and understanding of reducing emissions from food systems
- Knowledge of bioprocesses and applied microbiology
- Experience in designing or operating of bioreactors or a basic understanding of bioprocesses
- Knowledge of microbiology and understanding of microbial communities is also desirable
- An interest in anaerobic digestion and biological treatment technologies
- Interest in understanding the impact of sustainability and impact assessment of technological interventions
- Excellent written and oral communication and interpersonal skills
- Basic IT computational analysis skills
- Excellent qualitative and quantitative research skills
- An interest in innovation and entrepreneurship

Application Procedure

Applicants should submit in one document: a cover letter setting out your motivation for applying for the role and how your skills meet the requirements set out in this document AND a full Curriculum Vitae to include the names and contact details of 2 referees (including email addresses), by July 31st 2024 Noon (GMT) to:-
Professor James Lyng Email: james.lyng@ucd.ie and Dr Ajay Menon Email: ajay.menon@ucd.ie

BiOrbic

"This project is funded by BiOrbic, Ireland's National Bioeconomy Research Centre. BiOrbic is a national collaboration of researchers, focused on the development of a sustainable, circular economy. Encompassing 100+ researchers from twelve institutions in Ireland, along with International collaborators, BiOrbic is focused on training and developing the next generation of Bioeconomy leaders."