Research Project Details for Graduate Research Assistant (GRA) Recruitment

Research Project Title

Ultrasound-Assisted Extraction of Protein from Microalgae using Natural Deep Eutectic Solvent-Based Aqueous Two-Phase System

Programme Name

Master in New Energy Science and Engineering (Research Mode)
Master in Chemical Engineering (Research Mode)

Details of Primary Supervisor

1. Name: Dr. Ngan Cheng Loong
2. Department and University: School of Energy and Chemical Engineering
3. Email address: clngan@xmu.edu.my
4. Research interests: Bioprocessing, Foods and Pharmaceuticals, Green Chemistry, Deep Eutectic Solvents, Machine Learning

Details of Research Project

1. Duration: 2 years
2. Monthly allowance: RM 2,300.00
3. Summary:
   Disruption in global food markets, especially protein-rich foods, underscores the urgent need for alternative and sustainable protein sources like microalgae. Despite having high protein content, rigid microalgal cell walls reduce digestibility leading to low bioavailability due to trapped intracellular contents. This project aims to explore the use of natural deep eutectic solvents (NaDESs), in a liquid biphasic system to isolate protein from microalgae effectively by elucidating their phase-forming behaviour influencing phase separation. Various NaDESs forming stable biphasic systems based on constructed phase diagrams will be evaluated for their partitioning ability. DES-based LBS and operating parameters will be optimised to determine the best-performing in terms of separation efficiency, protein recovery and yield. The extracted protein will be analysed and characterised for yield and quality by gaining insights on protein conformation. The secondary structures of protein will be verified to reveal its stability and not altered by NaDESs after the extraction process. The expected outcomes include an optimised DES-based LBS with excellent protein partitioning, unravelling the effectiveness of microalgal cell disruption in a liquid biphasic environment, and providing crucial insights on protein yield and quality obtained from this process. In line with SDG2, these findings provide a fundamental basis for upscaling protein production.

This research integrates the circular economy into protein production, optimising resource efficiency and emphasising inclusivity where affordable protein is made available to everyone.

4. Skills/techniques development:
   Deep eutectic solvent synthesis; liquid-liquid extraction and recycling; microalgae cultivation; kinetic modeling; physicochemical characterization and analysis (SEM/TEM-EDX, UV-Vis, FTIR, HPLC, TGA/DSC, CHNS/O, circular dichroism); experimental design and optimisation; scientific writing and journal publication.
5. Location: Xiamen University Malaysia

GRA Requirements:

Number of Master places available: 2

1. The candidate must be enrolled in XMUM Master or Ph.D. programme.
2. Bachelor's degree in Chemical Engineering, Environmental Engineering, Chemistry, or a related field, with minimum CGPA of 3.50 or above.
3. Good command of English (written and spoken) with the ability to analyse experimental data, prepare technical reports and contribute to journal publications.
4. Self-motivated, able to work independently and as part of a team, follows laboratory safety practices, and is committed to full-time research for the funded period.
5. Strong interest in microalgal biotechnology, bio-separation processes, green chemistry, tissue engineering.