Opportunities for Student Traineeships in Australia

Where: CSIRO, Melbourne, Australia

Duration: 5 months or longer

Stipend: AU$150 per week

Contact: Pablo Juliano, pablo.juliano@csiro.au

-- Expressions of interest can be received anytime --

The details

Interested in projects in Australia’s national scientific and industrial research organisation? We are currently recruiting students who would like to be part of strategic industrial research projects currently ongoing at CSIRO Food and Nutrition. The student will become an integral part of a research team that explores the application of high frequency ultrasound to enhance oil separation and recovery. The application of ultrasound high frequency standing waves (megasonics) on oil bearing pre-macerated materials has been demonstrated to predispose the product to enhance the separation and recovery of oil during extraction processes for palm oil, olive oil, and coconut oil. The technology has been implemented in the palm oil industry following the demonstration at laboratory and pilot scales (Juliano et al. 2013a,b). A commercial megasonic reactor unit developed by our team currently treats pressed palm fruit slurries continuously to promote oil separation through emulsion breakage (involving enhanced coalescence and other separation phenomena), therefore maximising the recovery of palm oil from fruit paste and minimising oil loss in effluents. The megasonics assisted recovery of oil has also been demonstrated at laboratory scale in the coconut and olive oil processes. Different research questions will be addressed into three key projects.

Project 1 – Sound penetration in oil bearing materials for megasonic reactor design

Description of the project (total duration: 5+ months)

A challenge to scale the megasonics technology up is the understanding of penetration of sound in the paste, which will enable determining the distance between high frequency transducer plates and the opposite vessel wall. Determining the maximum sound penetration distance will enable calculating the maximum cross-section of the vessel to maximise paste/slurry throughput. Current hydrophones are operational only in water and a special hydrophone design is required to measure sound penetration through dispersions and slurries.

General aims

This project aims at:

1. Developing and testing a metallic membrane that will enable measuring sound penetration through food material dispersions and slurries
2. Testing sound penetration across various distances using a testing trough in coconut:water mixtures and in olive paste (as per Leong et al. 2015)
Expected outputs
1. Sketches on potential megasonic vessel designs according to the measured data
2. Manuscript draft and oral presentation

Activities/traineeship undertaken will include the following:
1. Review of the literature on existing hydrophones and measurements on solutions, dispersions and slurries (containing food) (2 weeks)
2. Assist in the development of the hydrophone adaptor (1 month)
3. Conduct measurements in various materials (2 months)
4. Conduct vessel design calculations and sketches (2 weeks)
5. Write a project report in the form of a potential publication and oral presentation (1 month)

Project 2 – Application of megasonics to maximise olive oil extraction: frequency effects for selected olive varieties and fruit ripeness levels

Description of the project (total duration: 5+ months)
The megasonics assisted recovery of oil has also been demonstrated at laboratory scale in the olive oil process by evaluating interventions before and after malaxation with 600 kHz. However, it is yet unknown how high frequency ultrasound will impact in different olive varieties and in fruit pastes from fruits at different levels of ripeness.

General aims and expected outputs

This project aims at:
1. Evaluating the impact of fruit ripeness and olive variety on the ability of ultrasound to predispose olive paste to oil separation and recovery
2. Identifying the most suitable frequency to maximise olive oil recovery

Expected outputs
Report, manuscript draft and oral presentation

Activities/traineeship undertaken will include the following:
1. Review of the literature on current olive oil separation aids (2 weeks)
2. Various trips olive collection trips in conjunction with the team throughout the olive season (Months 1.5-5)
3. Management of olive oil storage and selection (Months 1.5-5)
4. Evaluation of oil extractability post-megasonic treatment using various varieties and green and mature olive fruit (Months 1.5-5)
5. Provide a project report in the form of a potential publication and oral presentation (Months 6)
Project 3 – Application of megasonics to maximise coconut oil extraction: effects on fresh coconut meat and material characterisation

Description of the project (total duration: 6 months)

The megasonics assisted recovery of oil has also been recently demonstrated at laboratory scale in the coconut oil process by identifying the most suitable frequencies for oil separation in combination with centrifugation. However, previous research has been carried out in frozen coconut meat. It is yet unknown how high frequency ultrasound will impact on fresh coconut meat oil recovery.

General aims and expected outputs

This project aims at:

1. Evaluating the impact of ultrasound applications on fresh coconut meat at various processing conditions to predispose oil separation and recovery
2. Investigating the composition and structure of coconut meat material after ultrasound treatments

Expected outputs

Report, manuscript draft and oral presentation

Activities/traineeship undertaken will include the following:

1. Review of the literature on current aqueous base coconut oil separation aids (2 weeks)
2. Characterisation of coconut meat before and after ultrasound using analytical and microscopic methods (preliminary trials) (Months 1.5-5)
3. Ultrasound trials with fresh coconut meat – determination of oil and protein extractability after testing selected frequencies/frequency combinations/ temperatures and centrifugation conditions (Months 1.5-5)
4. Provide a project report in the form of a potential publication and oral presentation (Months 5-6)

References


Leong, T. Coventry, M., Swiergon, P., Knoerzer, K., Juliano, P. 2015. Ultrasound pressure distributions generated by high frequency transducers in large reactors, Ultrasonics Sonochemistry, 27:22-29