Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name :	BALS	Given names :	Olivier
Status (prof., assistant prof., …) :	Professor		
Laboratory :	Transformations Intégrées de la Matière Renouvelable	Website address :	www.utc.fr/timr
Institution :	Université de Technologie de Compiègne	Website address :	www.utc.fr

Scientific competence of the supervisor:

Food and Process Engineering, Mass transfer modeling, Freezing

Two major publications in the field proposed for the PhD :

1. Huang, Y., et al. Pulsed Electric Field Assisted Combined Freezing of Carrot Tissue: Preliminary Vacuum Freezing Followed by Supplementary Conventional Freezing. Food Bioprocess Technol 18, 4649–4657 (2025).
2. Huang, Y., Bals, O. Application of Vacuum Freezing to Improve the Quality of Thawed Carrot Discs; Food and Bioprocess TechnologyVolume 18, Issue 1, Pages 219 - 230 (2025).

Website address of the personal page :

Supervisor's email : olivier.bals@utc.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** II-9, II-13, V-17

Title : Impact of emerging technologies on the freezing process of fruits and vegetables: experimental and modeling approaches

Subject :

The preservation of fruits and vegetables through freezing and drying is a widely adopted method due to its ability to extend shelf life while maintaining nutritional and sensory quality. However, conventional freezing techniques often result in the formation of large ice crystals, which can damage plant cell structures and compromise texture upon thawing. This research thesis aims to explore how emerging technologies—such as microwaves and ultrasound-assisted freezing—can enhance the efficiency and quality of the freezing process. The study will begin with the optimization of key process parameters, including air temperature and velocity, product geometry, and the biochemical composition of different fruits and vegetables. A particular emphasis will be placed on understanding ice nucleation and crystal growth mechanisms within plant tissues, using microscopic and imaging techniques. Microwave-assisted freezing will be investigated to determine its influence on ice crystal morphology and the potential for reducing freezing time. Similarly, ultrasound technology will be evaluated for its ability to enhance heat and mass transfer, leading to finer and more uniform ice crystal formation. The impact of these technologies will be assessed through a combination of physicochemical, microstructural, and textural analyses, both immediately after freezing and during storage. Water release, firmness, and structural integrity will be monitored over time to evaluate the long-term effects of the freezing

Keywords :

Freezing, vegetables, microwave, ultrasound, modeling

Expected collaborations :

Background required from the applicant :

Process engineering, Chemical engineering, Food Engineering, English (level B1)

Existence of a PDF file detailing the proposal ("yes" or "no") : no

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