

Palaiseau

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About me

Erasmus Mundus Joint Masters
in Food Innovation and Product
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Project start : April 2026

ModIC

*Modeling and engineering by
calculation*

Supervisors : Hayat
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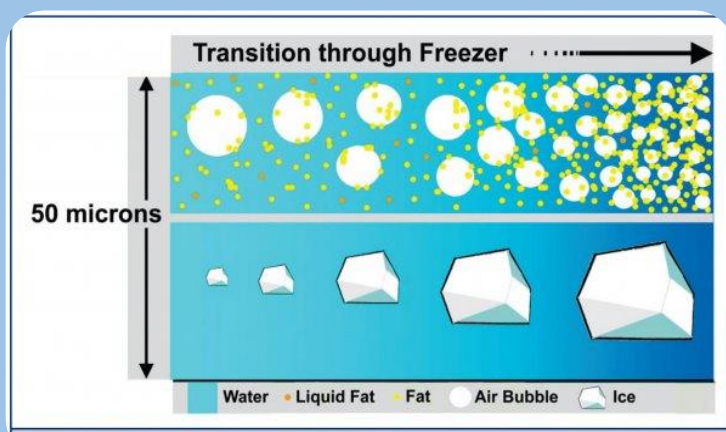
Key words

Ice cream, Modeling,
Continuous freezing,
Crystallization

Continuous freezing process of ice cream through experimental approach and multi-scale modeling

Graphical abstract

Continuous freezing is the critical step in microstructure formation

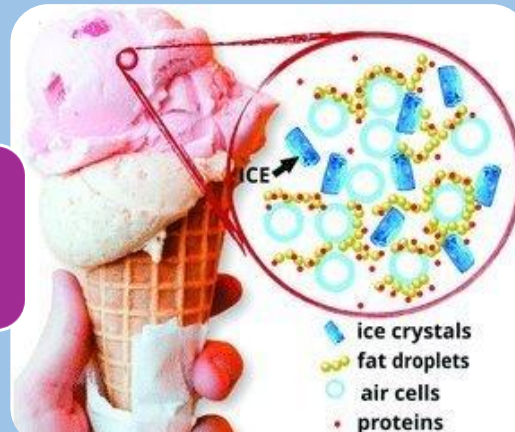


Images adapted/sourced from Azeredo HMC, Barud H, Farinas CS, Vasconcellos VM and Claro AM (2019) Bacterial Cellulose as a Raw Material for Food and Food Packaging Applications, Goff, H.D. & Hartel, R.W. (2013). *Ice Cream Structure*.

Consistent
product
quality

Uniform
production

Ensure
scale up



Objectives

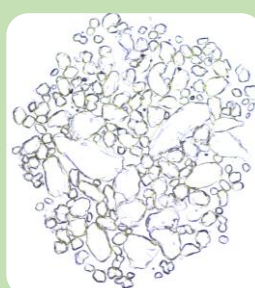
- Establish a link between key freezing conditions, microstructure and sensory attributes
- Develop a multiphysical model accounting for formulation and process condition.

Techniques methodology

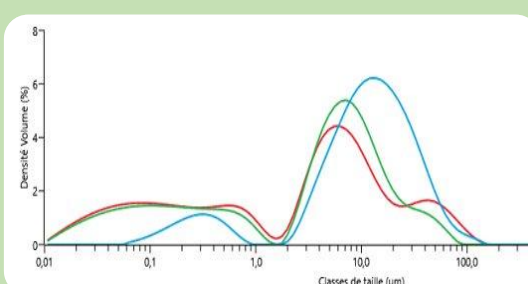
- Residence time distribution
- Population balance of ice crystals
- Ice crystal microscopy
- Inline measurements of key process parameters
- Sensory evaluation with trained panel



Examining relationship between process variables like freezer geometry, cooling rate, flow of mix and speed of agitation towards ice crystal and fat globule microstructure.

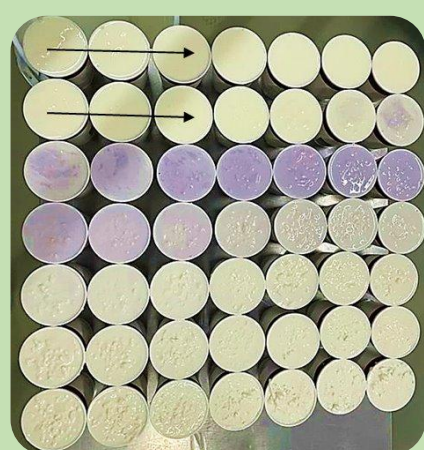


Ice crystals
imaged at 10X
and fat particle
size distribution



Model to be developed from flow behaviour and population balance equations and to be validated with experimental and sensory data

RTD determined through colourant pulse injection method



Funders & Collaborators

