An eco-efficient approach to valorizing buttermilk

Duration: 2019-2022

Highlights

- Buttermilk is a co-product of butter production obtained by churning cream, a process that breaks down the milk fat globule membrane (MFGM).
- While butter consumption is on the rise in Quebec, buttermilk remains an untapped resource despite its potential as a high added value bio-ingredient, specifically when derived from the milk fat globule membrane.
- However, the milk fat membrane fragments contain molecules that make processing buttermilk into cheese difficult. Separating the membrane components would make it possible to valorize the non-fat solids in different dairy matrices to improve its eco-efficiency.
- The objective is to develop different strategies to separate the MFGM from buttermilk by combining ultra high-pressure homogenization (UHPH), a continuous process that promotes protein aggregation, with baromembrane processes.
- The project aims to optimize the use of buttermilk by valorizing its non-fat solids and deriving high added value bio-ingredients from the MFGM.

Objectives

The main objective of this project is to develop eco-efficient separation strategies to optimize the use of buttermilk in the production of MFGM-rich, high added value bio-ingredients and to valorize buttermilk's non-fat solids in dairy matrices.

More specifically, the objectives are to:

1) Characterize the impact of the UHPH process parameters on the size of buttermilk components and determine the impact of concentrating buttermilk through reverse osmosis on the size modifications brought about by UHPH;
2) Optimize microfiltration (MF) operating parameters to maximize filtration selectivity and efficiency during the fractionation of buttermilk's MFGM processed through UHPH;
3) Determine the impact of incorporating buttermilk proteins that have been defatted through the UHPH/MF process in dairy matrices.

Results and potential benefits

This project will provide conclusive data on the separation of the MFGM from buttermilk. UHPH may have a major impact on membrane selectivity/permeability during MF separation by modulating the size of the components in buttermilk, specifically casein micelles and MFGM fragments. In addition, the effect of MF parameters (pressure, velocity and recirculation speed) on fractionation yield and selectivity, as well as on membrane fouling, will generate unique theoretical and technological knowledge about the fractionation of buttermilk processed through UHPH to recuperate the MFGM. The ability to produce MFGM concentrates will allow for the development of new added value applications for buttermilk. This will create opportunities to increase revenues for Quebec's dairy industry while restoring the technical-functional properties of buttermilk proteins and valorizing buttermilk's solids in more conventional applications, such as yogurt and cheese production. In the end, the project will lead to a better understanding of the denaturation and protein interaction caused by UHPH and the development of innovative new approaches to separate the MFGM from buttermilk.

Innovative aspects

- Total recovery of buttermilk components in two fractions: the bioactive components of the milk fat globule membrane (MFGM) and the techno-functional components of the buttermilk.
- Innovative combination of ultra-high pressure homogenization and baromembrane filtration to separate the MFGM from other buttermilk components.

Professional trained

- **Serine Touhami**, master's student

For further information

Research results will be promptly transferable to the dairy industry through different channels, including the STELA Colloquium, Novalait's Forum Techno and other scientific conferences. Other communication activities, including articles and presentations, will be planned for collaborating users.

Financial contributions

Special call for projects: Dairy production and processing (2016–2021):

- Natural Sciences and Engineering Research Council of Canada (NSERC)
- Quebec consortium for industrial bioprocess research and innovation (CRIBIQ)
- Novalait

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