Impact of the dynamics of the process and composition of fermented dairy products on their stability and rheological qualities

Duration: 2013–2016

Highlights

- The province of Quebec produces more yogurt (80%) than anywhere else in Canada.
- A number of factors determine yogurt properties, including the type of bacteria, milk composition (total solids, fats, serum protein/casein ratio) and the production process conditions.
- To date, most research has been completed on firm yogurt, whereas in Canada, stirred yogurt is mainly consumed. Stirred yogurt is obtained by breaking the gel after fermentation in tanks.
- During the conditioning process (stirring, pipe flowing and pumpage), the product is subject to shearing constraints which result in the destructuring of the protein matrix affecting the rheological properties. Once it has been packaged, the stirred gel is stored at a cool temperature and the gel particles can once again interact to partially reestablish the gel properties. At the time of consumption, the yogurt must have textural properties that are acceptable to consumers.
- Expected results: Identify the critical points in the yogurt production process; understand the composition characteristics that are important for shearing resistance and the ability to re-form a high quality gel during storage.
- Anticipated benefits: Equip the industry with decision-making tools to optimize the production process and increase the quality of stirred yogurt.

Objectives

- Our hypothesis is that the composition and conditioning stages of stirred yogurt affect the final yogurt characteristics.
- Our objectives are as follows:
  - To determine the effect of curd shearing during the production process on the rheological properties and quality of yogurt.
  - To determine the effect of the dairy mix composition on the sensitivity of curd to shearing and on its rheological properties.
  - To determine the impact of production parameters and cooling speed on the rheological properties of stirred yogurt.

Results and potential benefits

Composition characteristics: shearing resistance and the ability to re-form a high quality gel during storage

- Results: Composition determines the properties of stirred yogurt. A high fat content reduces syneresis and increases firmness and viscosity when stored at 4°C. The source of serum proteins (whey protein isolate vs. milk protein concentrate) has a slight effect on syneresis and varies depending on the smoothing temperature.

Identify the critical points of the yogurt production process

- Results: Increased shearing during conditioning (test) reduces firmness and viscosity except in the presence of a high fat content. For fat-free yogurt, it would be preferable to reduce shearing intensity. For high-fat yogurt, increased shearing reduces syneresis.

The test has demonstrated that only smoothing and cooling had an impact on syneresis, firmness and viscosity. During storage, stirring speed also had an impact. The sequence of the condition stages is important; different properties are obtained depending on whether smoothing is completed before or after cooling.

Improving quality control for stirred yogurt; supporting the development of optimal industrial practices

- Outcomes: Better control of production parameters and increased quality of stirred yogurt (increased consumer satisfaction, decreased downgrading of products, increased profitability). Requires a validation project conducted in-plant.
Currently, three master’s students are being trained in this project.

- **Valérie Guénard-Lampron** (MSc#1: obj. 1.2) is completing a thesis on the effect of the conditioning parameters of stirred yogurt on its rheological properties. Expertise: physical chemistry, processes

- **Noémie Lussier** (MSc#2: obj. 2.2) is completing a thesis on the role of fat content and fermentation speed on the development of the rheological properties of yogurt during stirring and storage. Expertise: physical chemistry, microbiology

- **Marc-Olivier Leroux** (MSc#3: obj. 3) is completing a thesis on the impact of cooling speed on the stability and rheological properties of stirred yogurt. Expertise: physical chemistry, processes

Currently, one doctoral student is being trained in this project.

- **Audrey Gilbert** (not funded by the project) (PhD#1: obj. 2.1) is completing a thesis on the impact of process dynamics and the composition of fermented dairy products on their functional properties. Expertise: physical chemistry

All four students plan to work in the dairy industry after completing their studies. They chose this project for the high degree of applicability of the results and its significance to the dairy sector.

### For further information

**Posters presented:**

- Guénard-Lampron, V., S. Grabowski, G. Bélanger, L.P. Desmarais, S. Villeneuve, D. St-Gelais, S.L. Turgeon. 2015 Conception et mise en œuvre d’un banc d’essai à l’échelle pilote pour étudier l’effet des opérations de production sur les propriétés du yogourt brassé. STELA Colloquium, Quebec City, Canada June 1–2

- Gilbert, A., L.E. Rioux, D. St-Gelais, S.L. Turgeon 2015 Effet des cisaillements des procédés de brassage sur la structure de laits fermentés STELA Colloquium, Quebec City, Canada June 1–2

- Lussier, N., D. St-Gelais, S. Villeneuve, S.L. Turgeon 2015 Rôle de la teneur en matières grasses et du type de brassage sur l’évolution des propriétés rhéologiques du yogourt. STELA Colloquium, Quebec City, Canada June 1–2

Individual meetings are possible with industry actors interested in hosting the research team to present the major findings.

### Financial contributions

Partnership for innovation in dairy production and dairy processing (EPI2011-2017):
- Fonds de recherche du Québec – Nature et technologies
- Ministère de l’Agriculture, des Pêcheries et de l’Alimentation du Québec
- Novalait

The scholarship FAST from INAF under the CRSNG CREATE program was granted to Audrey Gilbert, covering the first two years of her Ph.D. when she was not yet eligible for funding by this project.

**Total budget:** $220 000