



# Quality of stirred yogurt; stability and rheological properties

Duration: 2013 – 2017

## 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.
- Results obtained: several critical points during yogurt production were identified regarding resistance to shearing and the capacity to reform a 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

### Importance of composition: resistance to shearing and capacity to reform a 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. Reduction in casein ratio: serum proteins increase yogurt firmness and viscosity and reduce the serum mobility.

### Identify critical points during yogurt production

- 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.

### Improve 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. Improved efficiency development process for new products as it will be based on a better understanding of the systems.

## Professionals trained

Two master's students graduated during this project.

- **Noémie Lussier** (MSc#2: obj. 2.2) completed a thesis entitled [translation] "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) completed a thesis entitled [translation] "Impact of cooling speed on the stability and rheological properties of stirred yogurt." Expertise: Physical chemistry, process.

One master's student was fast-tracked to a PhD program (**Valérie Guénard-Lampron** MSc#1: obj. 1.2). Her thesis is entitled [translation] "Characterization of the rheological, physical and microstructural properties of dairy microgels: Impact of smoothing temperature and protein ratio." Expertise: Physical chemistry, process

Another PhD student is also being trained in this project.

- **Audrey Gilbert** (funded in part by the project) (PhD#1: obj. 2.1) is completing a thesis entitled [translation] "Impact of process dynamics and the composition of fermented dairy products on their functional properties." Expertise: Physical chemistry, process.

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

- Gilbert A., Rioux L-E., St-Gelais D., and S. L. Turgeon 2018. Whey protein content and smoothing temperature are tools to modulate stirred yogurt structure and rheological properties. 3rd Food Structure and Functionality Forum Symposium & the 3rd IDF Symposium on Microstructure of Dairy Products. Poster. Montreal, Quebec City, Canada, June 3–6, 2018.
- Guénard Lampron, V., S. Villeneuve, D. St-Gelais, and S.L. Turgeon 2017. Stirred yogurt smoothing at different temperatures with a pilot-scale unit. Poster. IDF World Dairy Summit, Belfast Waterfront, Northern Ireland, October 29 to November 3, 2017.
- Leroux, M.-O., S. Villeneuve, M. Reza Zareifard, S. Grabowski, D. St-Gelais and S.L. Turgeon. 2017. Effet de la vitesse de refroidissement et de la teneur en matières grasses sur les propriétés rhéologiques et physico-chimiques de yogourts brassés. STELA 2017 symposium, Accroître notre compétitivité face à la mondialisation. Poster #15. Quebec City, Canada, May 29–30, 2017.
- Lussier, N., D. St-Gelais, S. Grabowski, S. Villeneuve and S.L. Turgeon. 2016. Study of the effects of shear treatment, fat content and fermentation time on rheological properties of stirred yogurt. IDF World Dairy Summit. Poster #WDS-0170, p83. Rotterdam, the Netherlands, October 16–21, 2016.

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

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