PROORG

Case study : **Yoghurt**

The Case Study aims at testing the practicability of the Code Of Practice for organic food processing, developed in the european project ProOrg.
ProOrg has been funded in the scope of the 2017 Core Organic Cofund call.

CORE organic

ACTALIA

itab
l'Institut de l'agriculture
et de l'alimentation biologiques

CASE STUDY: YOGHOURT

Synthesis of a theorical case study

Table of content

1. Introduction

Dairy products are hugely consumed in Europe. In France, the nutritional health plan recommends eating at least one dairy a day and especially milk or yoghourt (PNNS 2019-2023). In France, the national regulation constrains the yoghurt process: milk have to be thermally treated before inoculation (min 63°C/30 min or 71,5°C/15s i.e. pasteurization).

This case study deals with yoghourt processing and comes from a first assessment made in the broad of the French network RMT Actia Transfobio. This is a theorical case study based on scientific and technical literature and expert's quotes. We warmly thank Actalia for their work on this case.

The scope of this assessment is focused on heating process and more specifically on 2 thermal scales.

2. Material and methods

The methodology used for this case study is the one developed in the ProOrg project and called the Assessment Framework (AF). It gives a framework for a multidimensional approach for several important aspects in the scope of organic processing *i.e.,* environmental sustainability, nutritional quality, and sensory quality.

Step 1 of AF: Establishing the context, case boundaries and validate indicators

This case study is a comparison of two different processes for making yoghourt. We choose deliberately to focus on the main techniques employed by French yoghourt makers for heating milk before bacterial inoculation:

- batch heating (which is the traditional way of making yoghourt but requires a long cooking stage) for 30 min at the temperature of 85°C.
- using a plate heat exchanger (which can be done on a continuous flow and requires much less time and temperature) for 15 seconds at a temperature of 72°C.

Figure 1 gives the processing steps of each process and shows the boundaries of the studied system (represented by the dotted orange line). In addition to the comparison of both heating processes, naturalness check was performed over raw milk.

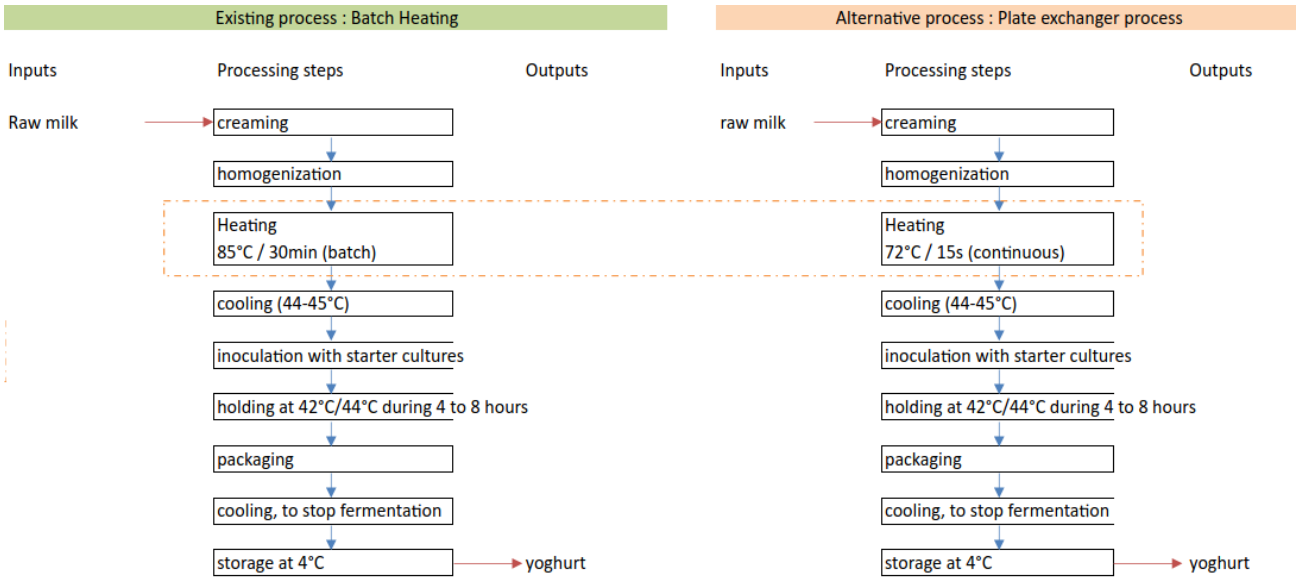

Figure 1: Yoghourt processing steps and studied boundaries (dotted orange line).

Relevant indicators were validated among milk processing experts, and data were collected in the scientific bibliography. Sometimes, data were not available in the literature, so forth experts gave semi-quantitative quotes.

The method established in ProOrg project gives the possibility to rate in a 5-points scale from quantitative continuous data. In this case study, we skipped the step of transforming quantitative data into a rating scale for expert rating as we did not have quantitative data.

The chosen indicators for each aspect are as follows, in Table 1.

Table 1: Aspects, criteria and indicators chosen of the yoghurt case study.

Aspect	Criterion	Indicator	Parameter	Impact
Environmental sustainability	Resources	Energy consumption	Expert rating	-
Nutritional quality	Macronutrients	Soluble protein denaturation	%	+
	Macronutrients	Soluble protein digestibility	Expert rating	+
	Macronutrients	Lysine content	%	+
	Vitamin	Vit C content	%	+
	Vitamin	Vit A content	%	+
	Vitamin	Vit B6 content	%	+
	Vitamin	Vit B12 content	%	+
Sensory quality	Enjoyment	In mouth texture	Expert rating	+
	Enjoyment	Spoon texture	Expert rating	+
	Drawback	Syneresis	Expert rating	-
	Drawback	Unpleasant taste	Expert rating	-
	Drawback	Coloration	Expert rating	-

The "Impact" column represents the direction of the rating scale (whether the scale is positive or negative, see Table 2). The positive scale is used for an indicator when a lower score indicates a worse performance. On the opposite, the negative scale is used when a lower score indicates a better performance.

Table 2: Conversion of normalized score into rating scale.

Rating scale		**Normalized score of the alternative technology**	
		Impact +	**Impact -**
-2	much worse	<50	>150
-1	worse	50-99	101-150
0	the same	100	100
1	better	101-150	50-99
2	much better	>150	<50

3. Results

Step 2 of AF: Assessment

The collected data can be found in the supplementary tables (excel worksheets). Two kinds of evaluations were performed:

- comparison of both processes by an overall score
- naturalness check which gives the impact of each process on the nutritional quality of the raw material

Step 3 of AF: Overall Evaluation and Naturalness check

Overall score

The process of yoghourt making with plate heat exchanger is rated 0.957 better than the process with batch heating. Environmental sustainability aspect obtains a score of 2.000; Nutritional quality a score of 1.205 and Sensory quality a score of -0.335. Plate heat exchanger seems thus to be better than batch heating for environmental and nutritional aspects.

Figure 2 shows the details of the overall score by aspects (green for sustainability, blue for nutritional qualities and orange for sensory criteria). The red circle is the baseline for the reference treatment *i.e.* batch heating and the grey line represents the alternative process *i.e.* plate heat exchanger.

Only 4 indicators are worse with the plate heat exchanger (3 sensory and 1 nutritional indicators). They were all obtained through expert rating (qualitative data) and should be confirmed with quantitative data.

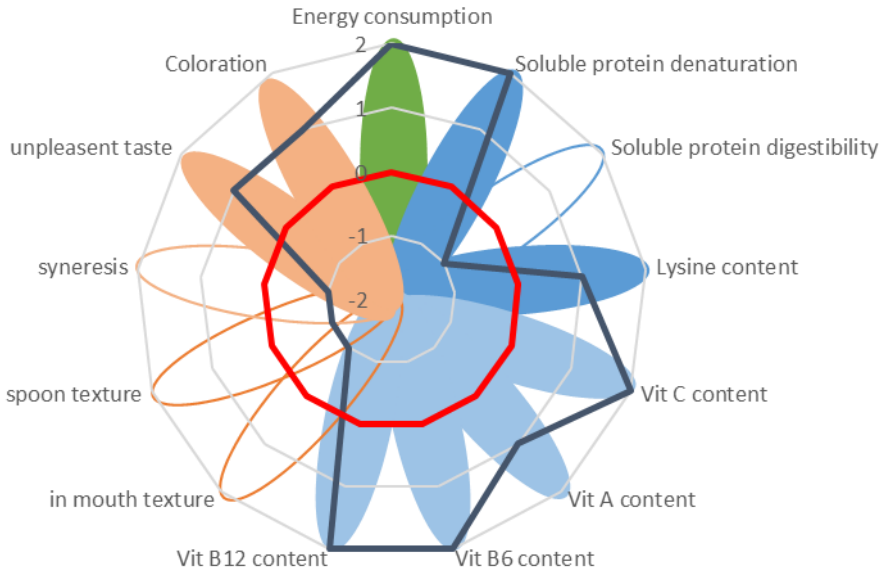

Figure 2: Spider map representing the score for each indicator. The red line represents the scores of the existing process (batch heating) and the grey line the scores of the alternative process (plate heat exchanger).

Naturalness check

The naturalness score for the batch heating process is -1.625. The naturalness check shows that the nutrient quality of this reference process is lowered by a factor of 1.625 compared to the raw material nutritional quality (milk).

The naturalness score for the process with plate heat exchanger is -0.785, The naturalness check shows that the nutrient quality of this alternative process is lowered by a factor of 0.785 compared to the raw material nutritional quality (milk).

It means that plate heat exchanger has a lesser impact than batch heating on the nutritional quality of yoghourt.

4. Discussion

Both processes have somehow a negative impact on nutritional quality when we compare the final product to raw milk. But yoghourt have other beneficial aspects not evaluated in this AF (for example probiotic consumption or vitamin rate increase by lactic acid fermentation).

The processes selected for this study have been chosen due to data availability. Anyway, we should have selected consistent processes linked with industrial practices (*i.e.,* 90°C/2 min in continuous line). This practice is used to avoid whey exudation for consumers expectations.

This theorical assessment give some clues to decide which process should be preferred for companies however this decision is not only based on the impact on quality of yoghourt. Some more important aspects could have higher priority like economical aspect which depend on the yield of the process and the volume of raw material which will be treated. So, depending on the size of the company, the choice of the equipment will be also a question of economic and consumer target.

In this AF, we see that some data are not collected due to a lack of scientific bibliography. Therefore, the results do not completely reflect the reality and should be completed with monitoring data from the field.

Another point that has to be pointed out is that sensory aspect is not very relevant as this aspect is very subjective and has to fit with company's marketing objectives.

5. Bibliography

Beal C. et Sodini I. 2003. Fabrication des yaourts et des laits fermentés. In Technique de l'ingénieur, traité Agroalimentaire, F6, 315 pp 2-16.

Amiot J., Fourner S., Lebeuf Y., Paquin P., Simpson R et Turgeon H., 2002. Composition, propriétés physicochimiques, valeur nutritive, qualité technologique et techniques d'analyse du lait In VIGNOLA C.L, Science et technologie du lait-Transformation du lait, École polytechnique de Montréal, pp 25-29 (600 pages).

Augustin M.A., Cheng L.J. et Clarke P.T. 1999.Effects of preheat treatment of milk powder on the properties of reconstituted set skim yogurts. International Dairy Journal. 9 pp 415- 416.

Vasbinder A.J., Alting A.C., Visschersa R.W. et De kruif C.G.2003. Texture of acid milk gels: formation of disulfide cross-links during acidification; International Dairy Journal; 13, pp 29-38.

Damin M.R., Alcaintara M.R., Nunes A.P. et Oliveira M.N, 2009. Effects of milk supplementation with skim milk powder, whey prottein concentrate and sodium caseinate on acidication kinetics, rheological properies and structure of nonfat stirred yaourt. LWT-Food Science and Technology. 42 pp 1744-1750.

Rapport de stage ACTALIA - RMT ACTIA TransfoBio

itab
l'Institut de l'agriculture et de l'alimentation biologiques

Case study from **ProOrg project**
Redaction: Solenne Jourdren (ITAB), Rodolphe Vidal (ITAB)
Layout: ITAB
Funding: Core Organic Cofund
Date: June 2021

To quote this document: Jourdren S., Vidal R., A ProOrg Case Study: The Yoghourt Assessment, 2021, 6 p.

Contacts:
solenne.jourdren@itab.asso.fr;
rodolphe.vidal@itab.asso.fr