Study of yoghurt formation

Application

Food

Objective

Determination of the gelation point of milk for yoghurt

Device

TURBISCAN® LAB

INTRODUCTION

A yoghurt is made by inoculation of milk with bacteria, which, between 42 and 44°C, will grow and reject some lactic acid. This acid is responsible for the coagulation of the casein micelles and the gelation of milk into yoghurt.
The study of this gelation process is usually done by a measurement of the pH. However, the variation of pH is quite small (from 6.5 to 4.5) and gives little information on the actual process.
We have followed the formation of yoghurt with a Turbiscan LAB, which exists in a thermoregulated version, enabling to maintain the sample at the temperature required for the growth of the bacteria. The analysis allows a close follow-up, in real time, of the gelation process and can give additional information regarding the measurement of the syneresis of the product and its stability with time.

METHOD

The yoghurt is made directly in the Turbiscan LAB measurement cells. 20 mL of UHT whole milk were put in the cell and left at 43°C for one hour.
A ferment, containing *Lactobacillus Bulgaricus* and *Streptococcus Thermophilus* was diluted in milk at 25g/L. It was used to inoculate the pre-heated milk.
The process of gelation of milk into yoghurt was followed for 18 hours, doing one scan every 10 minutes at 43°C. A measurement of the pH was made in parallel, in order to correlate results coming from both techniques.

RESULTS

Gelation of milk giving yoghurt is due to the coagulation of casein micelles, forming a network, hence the solidification of milk. This process is very easy to visualise using the Turbiscan LAB$_{thermo}$ and studying the evolution of the backscattering level with time.

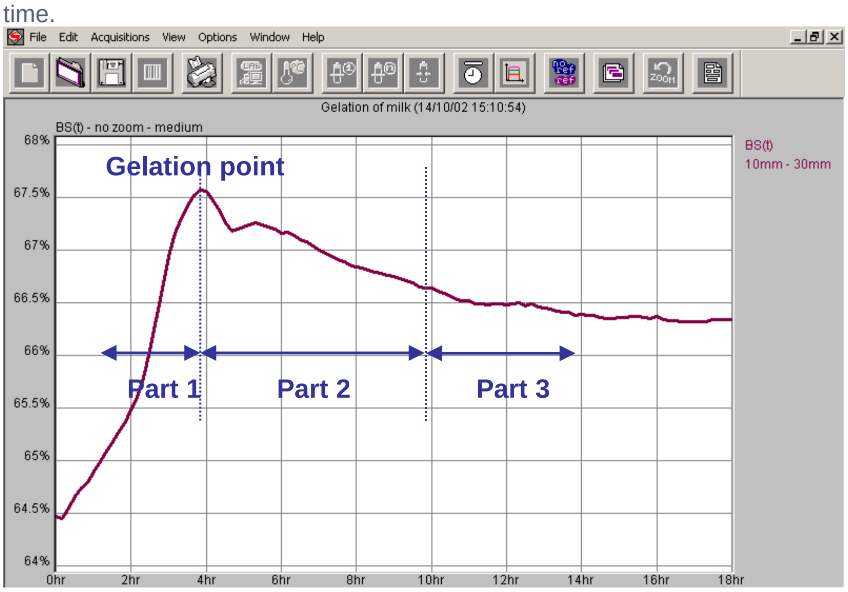

Figure 1. Kinetics of flocculation

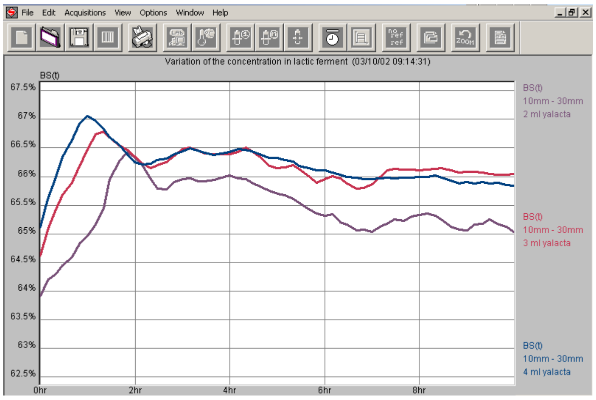

Figure 2. Kinetic s of flocculation for three concentrations of lactic ferment

It is therefore possible to calculate the kinetics of flocculation, by following the backscattering level in the middle of the sample (Figure 1). We can observe three different regimes:

- A first part where the backscattering level increases. It is due to the coagulation of the system. The level increases because the particles are small (around 0.3µm). Moreover, the flocculation is coupled with a bacteria growth (increase of the volume fraction), which increases the backscattering even more.
- A second part of the curve where the backscattering level decreases. This important decrease of backscattering is due to the end of bacteria growth. The top of the peak corresponds to the gelation point.
- In the last part of the curve, the backscattering becomes stable, corresponding to the end of the jellified network formation.

If we increase the amount of lactic ferment added in the milk, the coagulation process quicker and the gelation point comes sooner (Figure 2).
The gelation process has also been followed by measuring the pH of the solution (Figure 3).

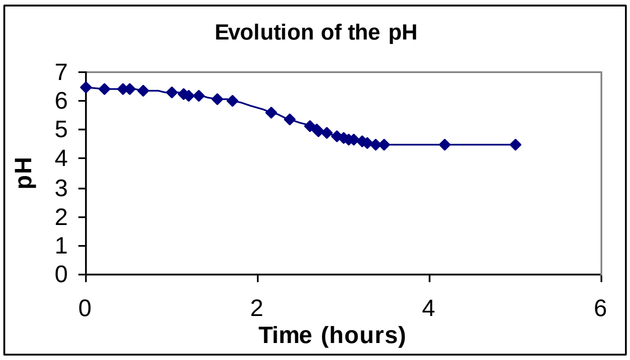

Figure 3. Evolution of the pH during the process of yoghurt making.

We can observe a decrease of the pH due to the growth of the bacteria during the gelation process and that it stabilises after 4 hours, which corresponds to the end of the bacteria growth seen on the backscattering profile. However, it is quite difficult to obtain more information on the actual process and its kinetics from the pH curve. Moreover, when working with the pH, it is necessary to wait until the pH stabilises, as with the backscattering, it is possible to have some information about the process in the first hours. The analysis made with the Turbiscan LAB seems more complete.

SUMMARY

The Turbiscan LA*b*^{thermo} is therefore a good instrument to use in the dairy industry. It enables to follow in details the gelation process giving yoghurt from milk. The equipment allows an optimisation of the process. Moreover, it can be used for stability study of the product with time (phase separation, syneresis).