

Milk coagulation ability

– Cheese making easy



Introduction

Several recent studies have shown that milk coagulation ability is widely influenced by genetics, feed, seasonal conditions, pollutants etc. Low milk quality considerably decreases the yield of cheese (loss of proteins by loose gel network). Rheolaser^{MASTER} uses a non-contact method, called Diffusing Wave Spectroscopy, which is perfectly adapted to study milk under real conditions (T, rennet addition, etc.). It detects gel formation and determines accurately the gel time and gel properties.

KEY BENEFITS

HIGHLY SENSITIVE
MULTI SAMPLE
ACCURATE



Passive microrheology with DWS

Rheolaser^{MASTER} uses MS-DWS based on multiple backscattering in the dynamic mode to analyze the viscoelastic properties. A typical result is shown in Figure 1.

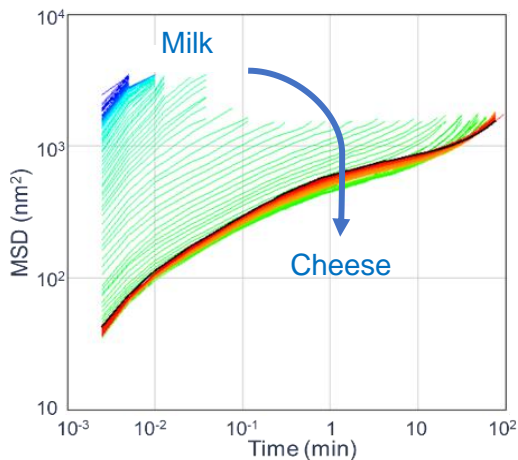


Figure 1: Mean Square Displacement (MSD) curves during cheese fabrication

Mean Square Displacement (MSD) curves contain the viscoelastic information. Short straight lines (blue curves) indicate liquid behavior of the sample, whereas curves with a plateau (red curves), so called elastic plateau, indicate gel-like or solid-like behavior of the sample.

Results and Discussion

Milk coagulation was studied under various conditions, such as rennet concentration, milk pH, pasteurization and temperature treatment. All results are represented as Elasticity Index (EI), which is the reverse of the MSD height at the elastic plateau. The higher this index is, the stronger the formed milk gel is. Figure 2 shows a typical evolution of the EI as a function of time calculated from the MSD curves of Figure 1. Several steps can be observed during milk coagulation by rennet addition. In the first minutes (1), the enzyme activity is low, and the rheological properties such as elasticity and viscosity did not change significantly. (2) indicates the flocculation of the casein micelles, which is the first step in milk gel network formation. Number (3) indicates the coagulation formation until the maximum elasticity given by EI_{max} (4). After that point, syneresis took place (5) which is indicated by a decrease of the Elasticity Index.

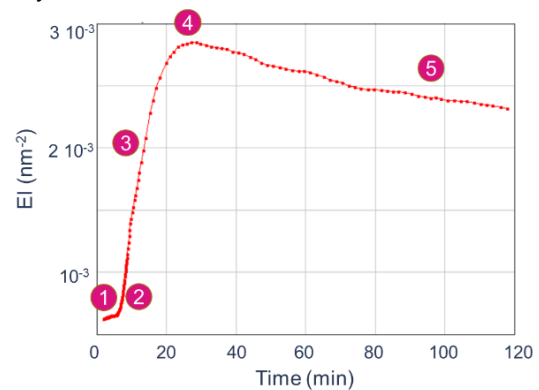


Figure 2: Elasticity Index of pasteurized milk at 70°C and at 85°C (33°C, no CaCl₂ addition, 20 mL/L).