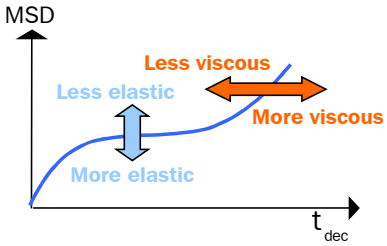
Viscoelastic characterization of cheese thanks to microrheology

Application
Food

Objective
Analyze the microrheology of cheese after two different processes and control the final quality of the product.

Device
RHEOLASER® LAB

Reminder about Mean Square Displacement



MSD curves are the signature of the product's microrheology. It reflects the visco-elastic behaviour of a sample.
By acquiring MSD curves at different ageing times for a same sample, it is therefore possible to identify the evolution of both viscosity, elasticity, and microstructural properties of a given product.

Introduction

Rheology of food stuff, such as cheese, salad dressing, butter… is a key parameter that must be controlled during and after the manufacturing process. Indeed viscoelastic behavior drives several end use properties like flow during a process, spreadability , shape stability, physical stability…
Microrheology enables to easily and deeply characterize these properties by measuring the viscosity and the elasticity of samples at rest, versus ageing time thanks to a non contact measurement, without the limitations of classical rheology (sampling issues due to the strong structure, weak structures not to be broken, …).

In this example, a same cheese was analyzed before and after a given process (for instance homogenization). The goal is to determine if the viscoelasticity is affected by the process.

Raw data: Particle Mean Square Displacement (MSD)

In microrheology, particles probe the viscoelastic behavior of the sample. Thus, particle Mean square displacement curve is the signature of the product rheology.

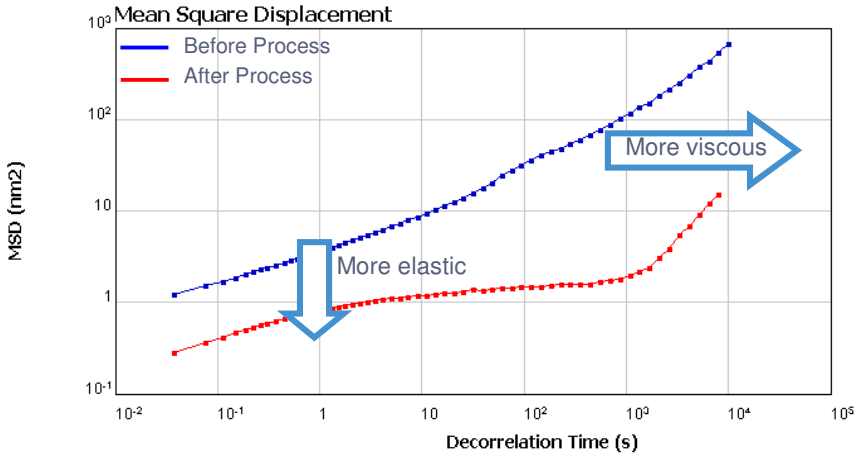


Figure 1. Mean Square Displacement of the cheese after the 2 distinct processes.

As we can see in the above graph, the MSD curve of the product before the process grows linearly with time which means that the viscosity dominates over elasticity.

After the process the MSD curve shows a plateau formation up to 10^3 s (=10^{-3} Hz) meaning a strong elastic behavior. After 10^3 s (Relaxation time t_R) the MSD curve increases, corresponding to the viscous behavior.

The macroscopic viscosity after the process is higher than before the process as the curve shifts to the right.