Optimizing the texture of a low-fat emulsion

Application

Food

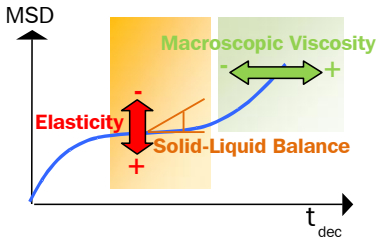
Objective

Decrease the fat content in a product by replacing some of the fat content by polymer.

Device

Rheolaser® LAB6

Reminder about Mean Square Displacement



MSD curves are the signature of the product's microrheology. It reflects the viscoelastic 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

The food industry faces a great challenge nowadays because people are more and more concerned about fat and sugar content of what they eat. Health is the centre of attentions, and the industry has to react by creating healthier products based on their old recipes. One of the solutions is to replace part of the oil phase by water in an emulsion, but by doing so, textural and sensorial properties will also change. It is therefore necessary to use additives such as stabilizers, thickeners and gelling agent to match the characteristics of the original product.
Additionally, these products are obtained from a wide range of natural raw materials (including microorganisms, land and sea structure, etc…), meaning that a great care has to be taken to insure a constant quality of the final product.

One of the key interests of microrheology and Rheolaser LAB6 here is that the user can prepare various formulas (up to 6) and compare them simultaneously by running a unique experience. Meanwhile, the optical technique allows characterizing these fragile products at rest, with no shear and/or denaturation.

In this example, the purpose is to decrease the oil content in an emulsion (from 75% v/v to 40% v/v), by using a given thickener (alginate) at various concentration, in order to match the textural properties of the original emulsion.

Raw data: Particles Mean Square Displacement (MSD)

In microrheology, particles probe the viscoelastic behaviour of the sample. Thus, particle Mean Square Displacement curve is the signature of the product rheology.
In this example, the goal is to match the rheological properties of a given product. The easiest way to do so is graphical: by adjusting the formulation to obtain the same MSD curve, the user can visually define the correct composition of his product.

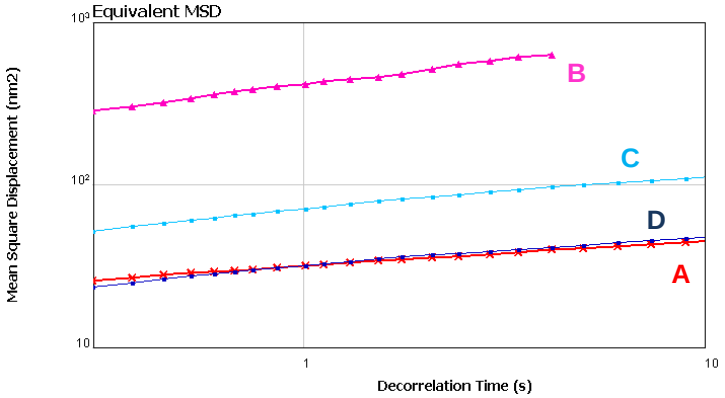


Figure 1. Mean Square Displacement of the original emulsion (A, red), the diluted emulsion (B, pink), the diluted emulsion + 0.4% of alginate (C, light blue) and the diluted emulsion + 0.8% of alginate (D, dark blue)

The original concentrated emulsion (75% v/v) has a low MSD curve, meaning the elasticity of the product is important. When diluting the emulsion, the effect on the MSD is very important (MSD curve is higher of more than one decade, meaning the elasticity has decreased drastically).
By adding polymer, it is possible to observe the MSD getting lower, first in an intermediary height (emulsion C) then in a similar level than the original emulsion, meaning the elasticity increases and reaches the same value than emulsion A.