Study of the gelling of an emulsion

Done in collaboration with ademtech

Application
Cosmetics

Objective
Characterization of the kinetics and the stability of an emulsion by aggregation

Device
TURBISCAN® LAB

INTRODUCTION
Gelling can be obtained through two main mechanisms: creation of a network due to a reticulation of polymers (it is the case for gelatin) or aggregation of particles (it is the case in yogurt). In the cosmetics industry it is commonly used to get various textures (Figure 1).
For a given system, adhesive interaction between the drops of emulsions depends on the temperature, the size of the drops, the concentration of salt and the volume fraction of the emulsion. The objective of the formulator can be to identify the interaction at the origin of the aggregation in the emulsion, to characterize the experimental conditions under which it arises or to characterize the gel and the kinetics of its formation, the conditions of its existence, of its stability, etc. We present a few results obtained on a model system.

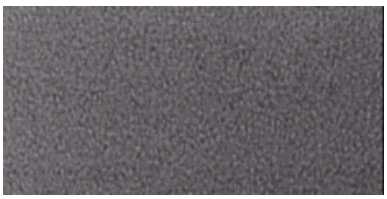
METHOD
We studied a hexadecane emulsion stabilized with SDS at the CMC. The average drop size is of the order of 1 µm.
In an initial series of experiments (a, b, c), we studied the influence of the salt concentration in the continuous phase. The emulsions are heated to 40°C and placed in the Turbiscan LAB.
In a second set of experiements, we studied the influence of the dispersed phase volume fraction (d, e, f). The intial emulsion is the same as before. Emulsions are heated to 60°C before being characterized by the Turbiscan LAB.

RESULTS

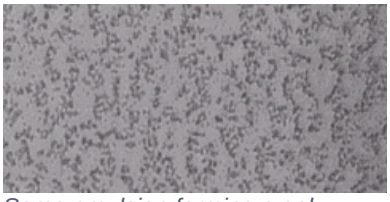
1. Salt Concentration

We present the results obtained with short cycles corresponding to the appearance of the adhesive interaction upon return to ambient temperature.

Upon return to ambient temperature, we observe a decrease in the homogeneous backscattering intensity in the sample (Figure 2). For sample b, this decrease is slow (20 min) and moderate (-6%) while for c, it is fast (10 min) and pronounced (-17%). For longer cycles, apart from a creaming phenomenon, the backscattering intensity at the core of the sample does not vary.
We can see the aggregation of the drops in the emulsion due to aggregation. When the salt concentration is low (b), small flocs form in the emulsion (with a slight lowering of backscattering). When the salt concentration increases, the aggregation between the drops becomes stronger and leads to the formation of aggregates of greater characteristic size (greater lowering of backscattering).



Initial emulsion



Same emulsion forming a gel

Figure 1. Optical microscopy snapshots of samples a and c at ambient temperature (lens 40).