TURBISCAN LAB

FOOD & BEVERAGES

Effect of fat content and homogenization on milk creaming

INTRODUCTION

Milk is a colloidal dispersion of particles (droplets of fat, micelles of proteins, lactose ...) in an aqueous phase.
There are many different industrial treatments of milk that lead to production of different milks: 1. sterilization (UHT, pasteurization, micro-filtration…) 2. centrifugation to fully or partially remove the cream 3. Addition of vitamins, calcium or other minerals, flavors etc. 4. reduction of lactose and so on. Depending on the final product, a “homogenization process” can be performed to uniform the size of fat globules, in order to delay the creaming phenomena and consequently extend the shelf life of milk.
In this application note, we propose a method to detect the effect of homogenization process on the stability of milk with different fat content.

KEY **BENEFITS**

VERSATILE

NO DILUTION

FAST AND ACCURATE

MATERIALS

Four different milks from the same supplier were analysed in a volume of 20 ml at 25°C over 12 hours:

1. A homogenized full-cream milk;
2. A non-homogenized full-cream milk;
3. A homogenized semi-skimmed milk;
4. A non-homogenized semi-skimmed milk.

Full-cream milk : 3.6% fat content;
Semi-skimmed milk : 1.5% fat content;
Homegenized (H) : by UHT;
Non-homogenized (NH) : by microfiltration.

EXPERIMENTAL RESULTS

The results obtained with Turbiscan for the four samples show similar backscattering profiles.

An example backscattering profile is shown in figure 1, the curves show the evolution of the delta-backscattered (ΔBS) light intensity (%, Y-axis) versus the sample height (mm, X-axis) and as a function of aging time from the blue to red curves.

BS decreases at the bottom of the samples, which is characteristic of a diminution of the concentration of dispersed particles in this area corresponding to a clarification phenomenon.

BS increases at the top of the samples, which is characteristic of an increase in concentration in this zone, in this case it means an increase in of fat droplets at the top corresponding to a creaming phenomenon.

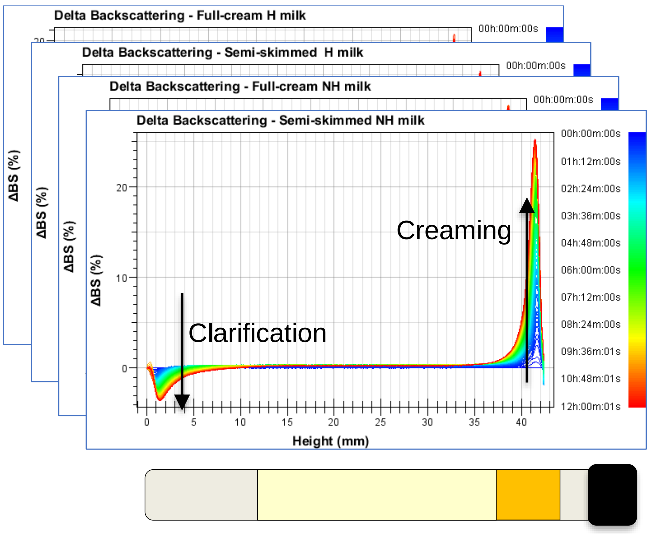

Figure 1: Delta backscattering ΔBS level (%) versus time for samples 1,2,3 and 4 at 25°C

The different milks are characterized by measuring:
- The global stability (TSI)
- Thickness of creaming layer

1- The global stability (TSI)

It is possible to monitor the destabilization kinetics in the samples versus ageing time, thanks to the Turbiscan Stability Index (TSI). It adds all the variations of signal detected due to destabilization phenomena (creaming, clarification, size variation, …). At a given ageing time, the higher is the TSI, the worse is the stability of the sample.

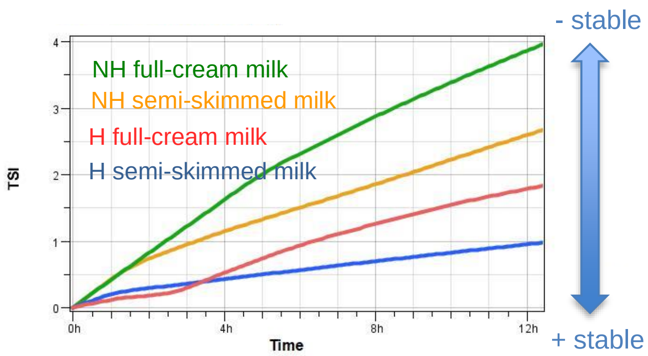

Figure 2: Turbiscan Stability Index versus time for all samples

Figure 2 shows that the homogenization process played an important role in stabilizing milks, as homogenized milks are more stable than non-homogenized milks. The full-cream milk that contains more oil droplets is less stable than the semi-skimmed milk. The stability depends directly on the fat content in the milk.

2- Thickness of creaming layer

Figure 3 shows the evolution of the thickness of the creaming layer formed at the top of the sample.

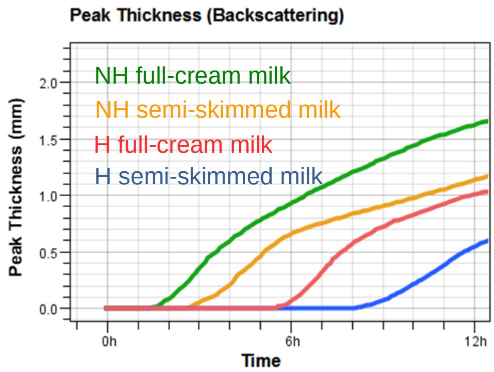

Figure 3: The thickness of creaming layer versus time in all samples

The cream layer appears later in the non-homogenized samples than for the non-homogenized samples. The homogenization treatment delays the undesirable destabilization, the destabilization starts 3 times later for the homogenized full-cream milk. The size of the fat globules in milk is between 0.5 and 10 µm and homogenization decreases this distribution to be 0.5 µm - 1 µm. The smaller the fat globules the slower the migration to the top.

CONCLUSION

Turbiscan technology can be used compare the cream formation in different milks that depends on two parameters: fat content and homogenization treatment. This undesirable destabilization is delayed by making the fat globule size uniform by using the homogenization treatment in both full-cream and semi-skimmed milks.

The graph below summarizes the stability calculations done in this study. The ranking shown in this chart matches the ranking shown in the calculations done above. The stability of these samples can be determined in a few hours with the Turbiscan®, this would take days or weeks to be observed with the naked eye.