REHYDRATION KINETICS AND STABILITY OF MILK POWDER

Foods

INTRODUCTION

In dairy industry, milk is often dehydrated. Indeed, milk powder has a longer shelf life than liquid milk, does not require refrigeration and as a result is easier to transport. However, dehydration must not alter milk properties; consequently, it is important to check if the rehydrated milk has the same properties than the native milk. Another aspect is to measure the rehydration kinetics in order to optimize rehydration process. In this note, we propose a method to assess the kinetics and the efficiency of rehydration of milk powder. The stability of rehydrated milk powder is also assessed.

METHOD

To achieve this goal, milk protein concentrate was rehydrated during 6 hours. During rehydration, sample was taken every 10 minutes and backscattering level was analysed with Turbiscan LAB. The results were compared to backscattering level of the sample before dehydration. Rehydration is completed as soon as backscattering level of native and rehydrated milk are equivalent.

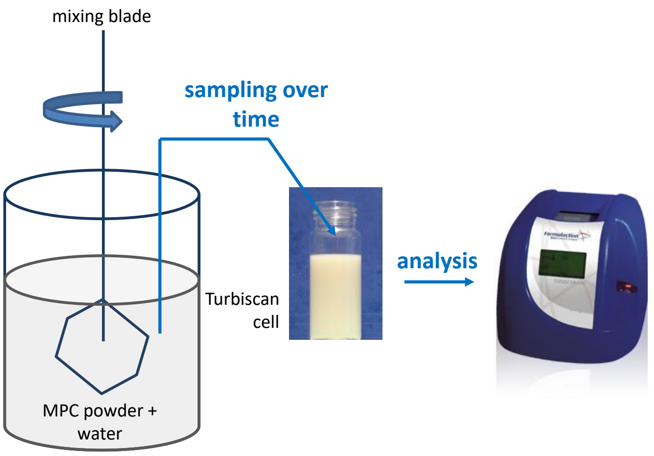

Figure 1: Schematic representation of the measurement method.

RESULTS

Rehydration kinetics

Backscattering level depends on 3 parameters: particle size, particle concentration and refractive index of both phases. Figure 2 displays the evolution of backscattering level with time for the rehydrated milk. Results are compared to the backscattering level of the native milk.

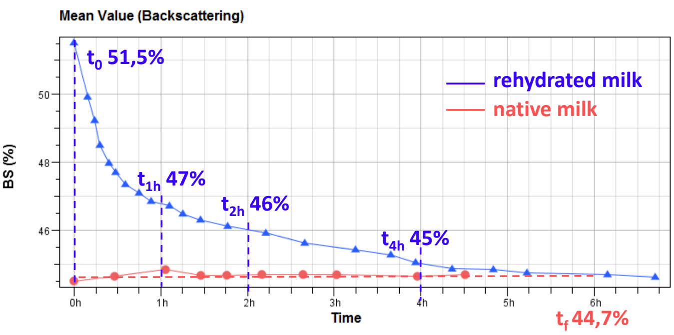

Figure 2: Mean value of the backscattering signal as a function of time for the rehydrated and the native milk.

This graph shows that immediately after rehydration, the rehydrated milk has a much higher backscattering level than the native one (51.1% vs 44.7%). Then, the backscattering level of the rehydrated milk decreases until it reaches the level of the native milk, i.e. same concentration and same particle size.

The rehydration is completed after **4 hours of mixing**. However, it is interesting to note that the rehydration process is not linear. Indeed, at the beginning of the rehydration, the backscattering level decreases fast. After 1 hour of mixing, the signal is already down to 47%, which means in other words that 2/3 of the rehydration process is achieved within an hour.

Stability of rehydrated powder

After rehydration, the stability of milk powder at 2 different concentrations (10% and 20%) was assessed for 1 day at 25°C.

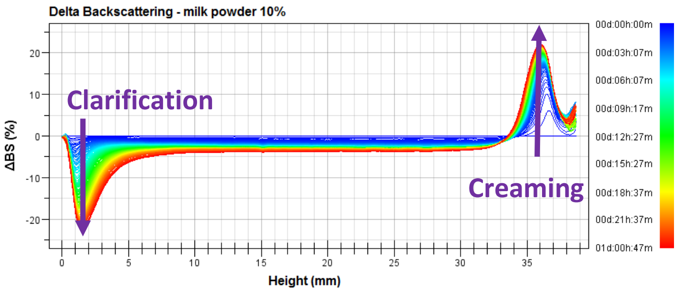

Figure 3: Turbiscan backscattering profile of 10% milk powder

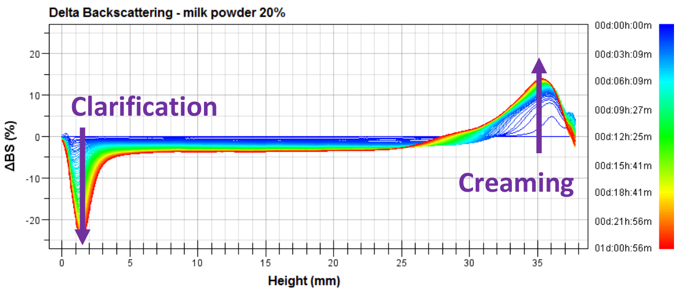

Figure 4: Turbiscan backscattering profiles of 20% milk powder

Thanks to these Turbiscan profiles, we can identify the destabilization phenomena occurring in the samples: for both milk powders, a creaming phenomenon is occurring in the top of the sample and a clarification is occurring in the bottom.

In order to assess global stability, all the destabilisations occurring in the sample have to be taken into account. The Turbiscan Stability Index was created in this purpose. This tool sums all the variations over the whole height of the sample. As a result, if the signal varies a lot, the TSI will be high; therefore, the higher the TSI, the lower the stability.

Figure 5 displays the evolution of TSI as a function of time for both milk concentrations.

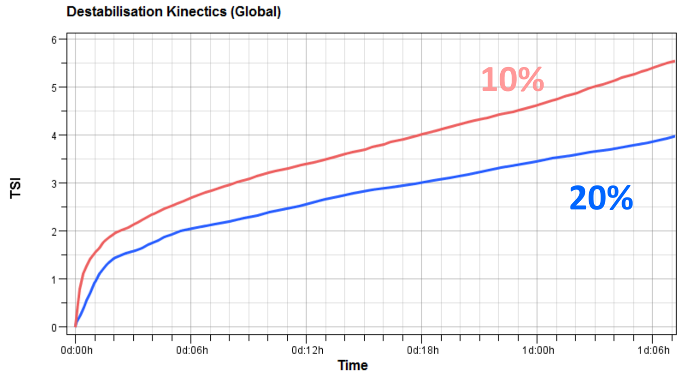

Figure 5: TSI values of samples at 10% and 20% at 25°C

This graph shows that sample at 20% concentration is more stable than the 10% one. The following table displays TSI values after 30 minutes and 1 day of measurement.

Sample	TSI@30min	TSI@1day
20%	0.4	3.4
10%	1.2	4.6

This table shows that samples can be differentiated after **only 30 minutes** of measurement.

SUMMARY

A simple method based on comparison of signals obtained with milk before and after rehydration is proposed to **control the rehydration of milk powder** using Turbiscan LAB.

Turbiscan LAB also allow to compare samples in terms on stability in one click using the TSI tool; in the present study, samples can be **ranked in only 30 minutes**.