EFFECT OF THE TEMPERATURE ON THE CLARIFICATION
STUDY ON THE WORT IN THE BEER MAKING PROCESS

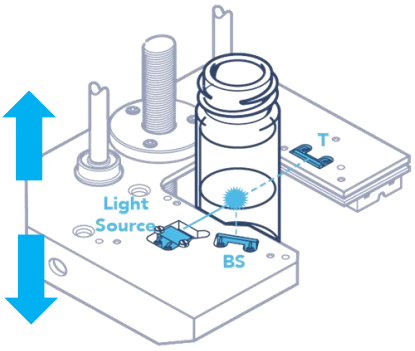
Context

The Wort is a sweet liquid that comes from Malt. The clarification of the wort is an important stage in the beer-making process and comes prior to the fermentation. The clarification occurs as the different impurities (residues of gluten, malt ...) are coagulated by the action of heat on the wort. More precisely, the tannic acid from the hops precipitates the different materials in suspension and makes the wort transparent.
This stage has to be controlled to a high degree of accuracy to get a good quality of the final product. In these experiments, the rate of wort clarification was compared over the same time, after heating the wort to different temperatures, following the process with the TURBISCAN device.

TURBISCAN: How it works

TURBISCAN technology, based on Static Multiple Light Scattering, consists of sending a light source (880nm) on a sample and acquiring backscattered (BS) and transmitted (T) signals over the whole sample height. By repeating this measurement over time with adapted frequency, the instrument enables to monitor physical stability.

The signal is directly linked to the particle concentration (φ) and size (d) by the Mie theory knowing the refractive index of continuous (n_f) and dispersed phase (n_p):



BS and T = f(φ, d, np, nf)

Method

Two different dispersions were analyzed (after coming back to room temperature):

Analysis conditions	
Sample number	2
Temperature	20°C
Duration	10 minutes

The first curve obtained was selected as a reference. The traces show the evolution of back scattered light intensity (%, Y-axis) on the tube height (mm, X-axis) as a function of time (last curve in red).

Results

The results show different kinds of transmission variation:

- a transmission increase in the middle of both samples (Figure 1), which is characteristic of the precipitation of particles. This corresponds to a clarification of the dispersion.
- a transmission decrease at the bottom of both samples (Figure 1), which is characteristic of the precipitated particles sedimenting and forming a layer.
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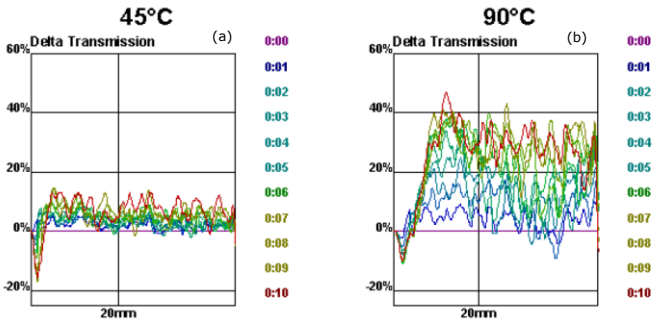

Figure 1. Delta transmission profile of the dispersion at 45°C (a) and 90°C (b)

By plotting the variation of the transmission in the middle of both samples as a function of time (Figure 2) we get a quantitative comparison of the rate of flocculation.

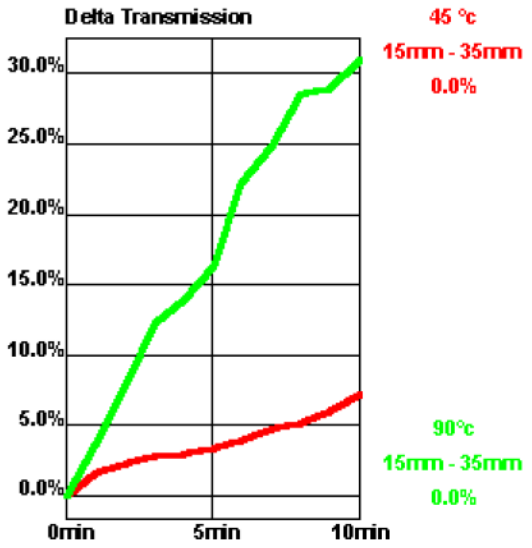

Figure 2. Comparison of the delta transmission signal between the measurement at 45°C and 90°C in the middle of the samples

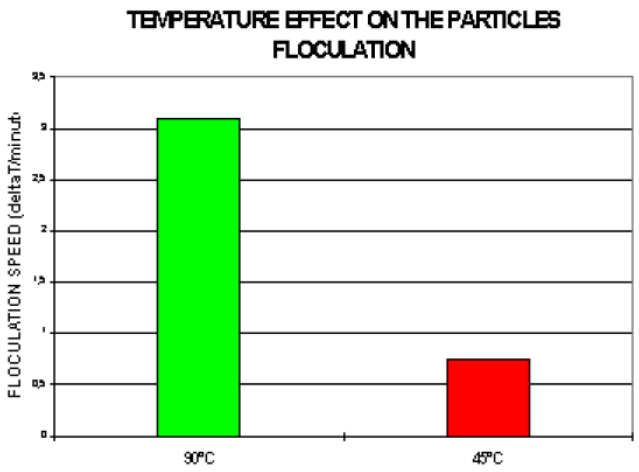

Figure 3. Temperature effect on the sample stability

Calculation of the slope of the graph over 10 minutes allows the determination of the sediment formation speed as a function of the maximum temperature of the wort (Figure 3).

The precipitation of the particles in the suspension by the tannic acid is 4 times faster if the wort is heated to 90°C compared to heating to 45°C; in fact, the clarification gets quicker when the wort temperature is increased.

Conclusion

TURBISCAN technology based on Static Multiple Light Scattering (SMLS) is the leading technology since 1994 to measure the stability of formulations and dispersions. This Application Note shows a quick and simple method to compare the formulation behavior in function of the heating process. The TURBISCAN instruments detect destabilization phenomena in a few minutes and allow a quantitative comparison of the results to be made. It is a useful tool to follow the process of beer making.