Fragrance and Stability in Home & Personal Care
Fast and quantify stability comparison

Introduction

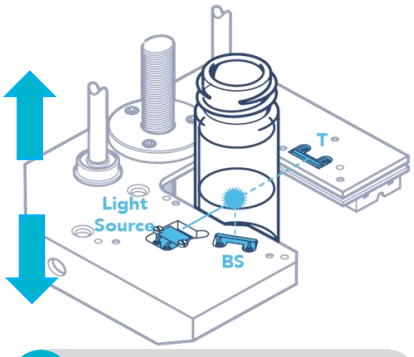
Today most Fabric Care products are liquid dispersions (laundry liquid detergent, liquid fabric softener, laundry gel, etc.) These products are constituted of many ingredients but are known to be kinetically stable. This means that the mixture remains stable throughout its shelf life without any instability signs like phase separation, cloudiness, flocculation, etc. The fragrance and/or microcapsules play an important role in consumers' perception of product quality. However, adding the fragrance to this already complex mixture can easily cause stability problems.

The TURBISCAN technology is a complete tool that enables the detection of variations in both clear and opaque samples. The variations are due to the particle and micelle movements and so is representative of the kinetics of destabilization (flocculation, sedimentation, phase separation, etc.). TURBISCAN can detect these phenomena hours or even weeks before the visual control conclusions.

Reminder of the technique

TURBISCAN instrument, based on Static Multiple Light Scattering, consists of sending a light source (880 nm) on a sample and acquiring backscattered and transmitted signals. Combining both detectors (BS & T) enables to reach a wider concentration range. The backward reflected light comes from multiple scattering (photons scatter several times on different particles or drops).

This signal intensity (BS) is directly linked to different parameters according to the Mie theory:



BS and T = f(φ, d, np, nf)

Method

In this application note, 2 different studies are shown:

- Fragrance stability in a heavy-duty liquid detergent
- Study of instability reason in liquid detergent formulation

Fragrance stability in a Heavy-duty liquid detergent

This study aims to limit the effect of fragrance on the final stability. Three emulsions are studied:

- Stable un-perfumed liquid detergent (use as the target)
- Liquid detergent with original perfume
- Liquid detergent with optimized perfume

All formulations are analyzed using the TURBISCAN technology at 45°C for 7 hours, the following graph is obtained.

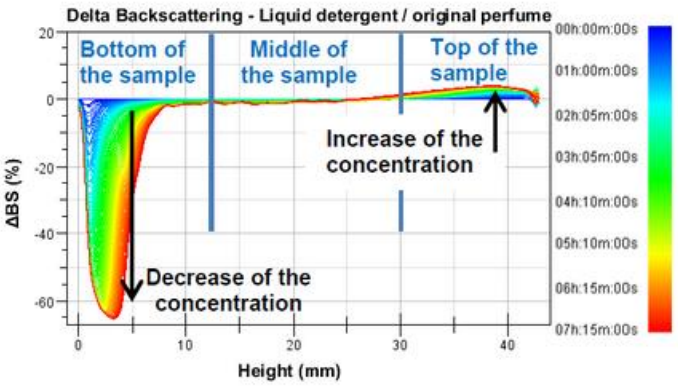


Figure 1. Backscattering variation for a sample with the original perfume

From Figure 1, we can observe a phase separation of the emulsion. At the bottom of the sample (left of the graph), light intensity decreases meaning that the oil concentration decreases. At the top of the sample (right of the graph) light intensity increase is observed corresponding to the oil creaming.

It is possible to monitor the destabilization kinetics in the samples versus aging time, thanks to the **T**urbiscan **S**tability **I**ndex (**TSI**). It sums all the variations detected in the sample (creaming, clarification, size variation) and quantifies it with a single number. At a given time, the higher the TSI, the worse the stability of the sample.

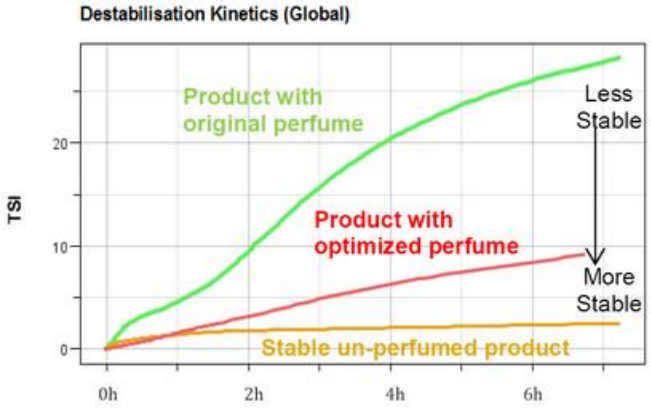


Figure 2. TSI of all samples

Sample	TSI (7 hours)
Original perfume	26
Optimized perfume	8.4
Unperfumed	2.3

Table 1. TSI values after 7 hours of all samples

As observed in Figure 2 and Table 1, the original perfume affects significantly the stability of the formulation. Consequently, the fragrance was optimized to reach an acceptable level of destabilization according to the internal criteria. Thanks to the TURBISCAN and the automatic computation of the TSI, the most stable fragrance formula in the liquid detergent base was identified in only a few hours as compared to days or weeks with visual observation.

Study on instability reason in liquid detergent formulation

In this second study, an unstable liquid fabric softener has been investigated to identify the reason for the instabilities. The destabilization can be observed visually, a phase separation appears and so the fragrance-free oil and the encapsulated perfume are floating at the top of the samples after a few days of storage at 37°C.

The formulation is constituted of:

- Fragrance-free oil
- Encapsulated fragrance
- Unperfumed base of the liquid softener

All the ingredients are analyzed with the TURBISCAN® for 7 hours. The TSI is automatically computed from the software, and the following graph is generated.

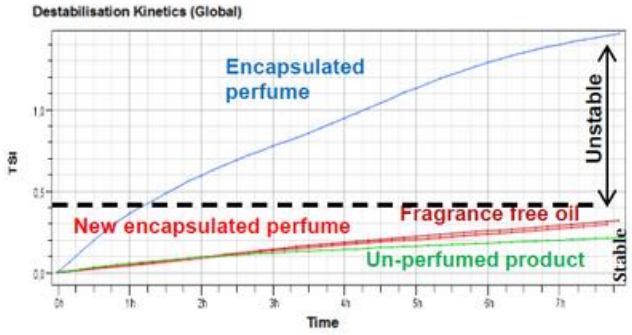


Figure 3. TSI of all samples

Sample	TSI (1 hour)	TSI (7 hours)
Encapsulated perfume	0.38	1.4
New encapsulated perfume	0.07	0.3
Fragrance-free oil	0.07	0.3
Unperfumed product	0.07	0.2

Table 2. TSI values after 1 hour & 7 hours of all samples

In only 7 hours it was possible to identify that the encapsulated fragrance was the main cause of the instability. However, after just 1 hour the same conclusion could be made. Based on this information, the fragrance system was modified and so the instability issue was solved. In Figure 3 and Table 2, we observe that the new fragrance system provides a stable product.

Conclusion

TURBISCAN provides a quick and simple method for characterization of the fragrance effect on stability. It was also possible to rapidly identify the reason for instabilities in a formulated product by analyzing each phase separately. Thanks to the generated data, the issue was corrected and the product improved.