EFFECT OF INGREDIENT QUALITY ON COSMETIC FORMULATION

INTRODUCTION

The nature and the quality of a constituent in a formulation may have an impact on its final stability. Consequently, the stability of the dispersion (suspensions, emulsions, foams, …) have to be control for all supplier to validate the stability. When dealing with natural products, the quality of the raw material from one supplier to another one may change significantly the properties of the final formulation.

In this note, the effect of two identical natural oil coming from two different suppliers was studied using the Turbiscan™ technology.

PRINCIPLE

Measurement with Turbiscan®

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

This signal intensity is directly linked to the diameter (d), according to the Mie theory:

$$d = f(BS, \varphi, n_p, n_f)$$

More information

METHOD

In order to monitor the impact of the quality of one raw material (jojoba oil), two different cosmetic emulsions were prepared with Jojoba oil coming from 2 different suppliers:

- Sport Lotion - Jojoba Oil supplier 1
  - Jojoba Oil Supplier 2
- Sensitive Lotion - Jojoba Oil supplier 1
  - Jojoba Oil Supplier 2

Samples are analyzed during 1 day at 43°C

RESULTS

By scanning the 3 samples according to the method described in the previous paragraph, the following results are obtained:

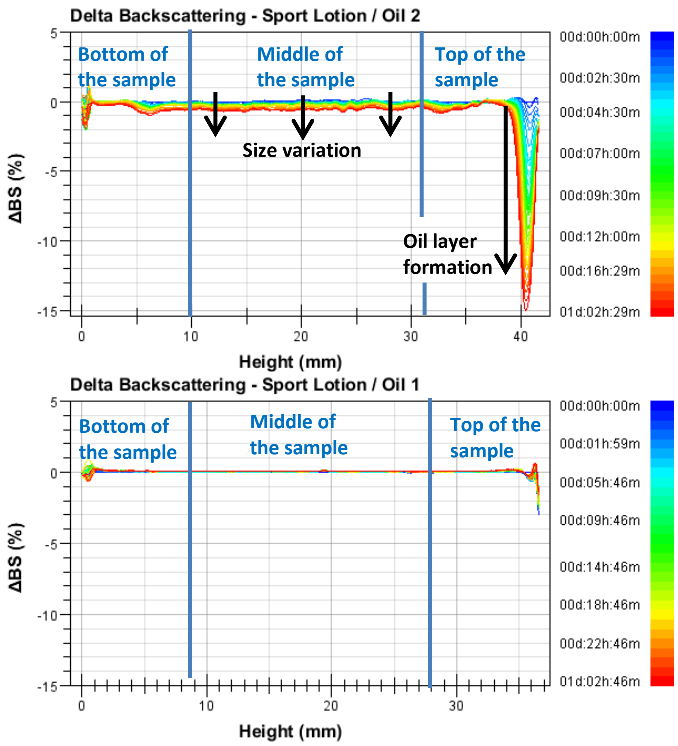


Figure 1: backscattering variation versus sample height for "Sport Lotion" from supplier 2 (top) & supplier 1 (bottom)

From the graphs in Figure 1, we can observe the effect of the oil quality on the emulsion stability. For the same emulsion, with supplier 1, no or minor destabilization is observed whereas we can observe the following destabilization with supplier 2:

- At the top of the sample, due to the creaming of the oil, a clear oil layer is forming at the top of the sample and so a decrease of the light intensity is observed.
- Moreover, a global decrease of the light intensity is observed at the middle of the sample meaning an increase of the droplets size.

To evaluate the impact of raw material quality on the stability, the following parameters are measured:

- The global stability (TSI)
- Migration rate
- Mean diameter of the oil droplets

1- Global stability (TSI)

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

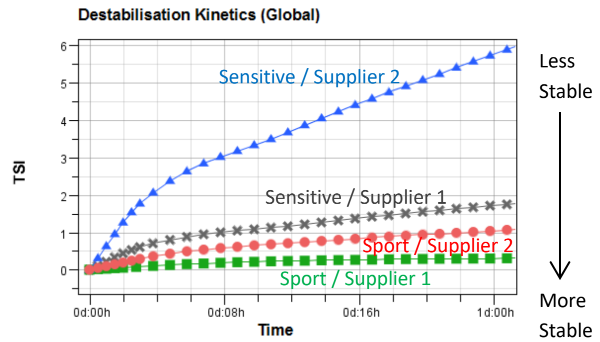


Figure 2: Turbiscan Stability Index for all samples

Sample	Suplier	TSI (1 day)
Sport Lotion	1	0.3
Sport Lotion	2	1
Sensitive Lotion	1	1.7
Sensitive Lotion	2	5.8

Table 1: TSI values after 1 day of measurements

From Figure 2 and Table 1, we can conclude:

- The formulation "Sport lotion" is more stable than "Sensitive lotion"
- Emulsion made from Supplier 1 provide better stability on the final product
- In only 1 day at 43°C we can discriminate samples compare to several weeks with visual observation

2- Migration rate of the oil droplets

By measuring the thickness of the oil layer over the duration of the measurement (Figure 1), the migration rate of the oil droplets can be computed (Table 2)

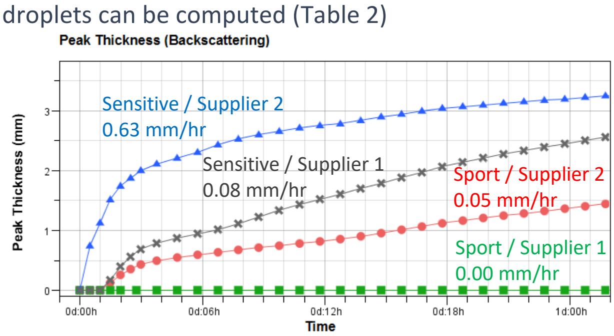


Figure 3: Thickness of the oil layer over time

Sample	Suplier	Migration rate (mm/hr)
Sport Lotion	1	0.00
Sport Lotion	2	0.05
Sensitive Lotion	1	0.08
Sensitive Lotion	2	0.63

Table 2: Values compute from graph in figure 4

The migration velocity of the oil droplets is significantly higher from the oil coming from supplier 2 leading to a fastest phase separation of the lotion.

3- Particles Size

The Turbiscan™ technology allows us to measure the mean diameter of the droplets in a concentrated media (no dilution). Using the Mie theory law and the parameters below, the mean diameter is automatically measured from the % of backscattering at time 0.

- Refractive index : Jojoba oil np = 1.4650; water nf = 1.33
- Volume fraction of the dispersed phase ϕ = 30 %

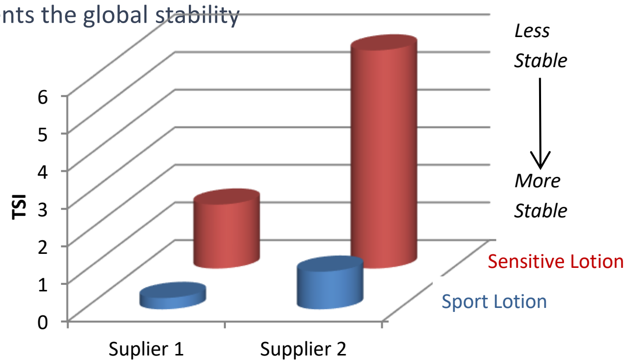
Sample	Suplier	Mean diameter (µm)
Sport Lotion	1	9.19
Sport Lotion	2	21.52
Sensitive Lotion	1	12.35
Sensitive Lotion	2	26.61

Table 2: Mean diameter of oil droplets

Lotions made with the oil coming from supplier 2 are less stable due to the higher mean diameter of the droplets at time 0.

Summary

This application note shows a quick and simple method to validate raw material quality in only 1 day versus weeks with visual observation. To summarize, the graph below represents the global stability



We can conclude that the oil from supplier 1 provides better stability and the formulation "Sport Lotion" is more stable than "Sensitive Lotion".