Study of a slow breaking foam

Stability of a shaving foam

Introduction

Foam is a substance that is formed by trapping pockets of gas in a liquid (or solid). Depending of the final application, they could be very unstable products with a shelf life that doesn't exceed few minutes (like hair foam) or more stable product with a shelf life of hours or days. In the case of shaving foams, the stability of the foam has to maintain stable during the time of application at the body temperature (37°C). Therefore the kinetics of breaking is a fundamental parameter for the formulator. However, this characterization is very difficult to perform due to the fragility of the system.

Thanks to the Turbiscan™ technology and its ability to scan the sample over time, it is possible to study and characterize all type of foam. In this application note, two different shaving foams have been characterized in order to compare the stability of different formulation.

Reminder on the technique

Turbiscan® technology, based on Static Multiple Light Scattering, consists on sending a light source (880nm) on a sample and acquiring backscattered (BS) and transmitted (T) signal all over the sample height. By repeating this measurement over time at adapted frequency, the instrument enables to monitor physical stability.
The signal is directly linked to the particle concentration (φ) and size (d) according to the Mie theory knowing refractive index of continuous (n_f) and dispersed phase (n_p):

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

Method

Commercial shaving foams were analyzed using the Turbiscan™ technology by scanning each sample from the bottom to the top at a frequency of one scan every 30 seconds for 3 hours. All the measurement were performed at 37°C to simulate the body temperature to evaluate the stability of the foam under real conditions. Due to the fragile structure of the foams they were generated inside the measurement cells to avoid any sampling.

At the end of the experiment, the refractive index of the resulting liquid is measured using a refractometer in order to be able to compute the mean diameter of the air bubbles over time with the Turbiscan™.

Results

1. Raw data

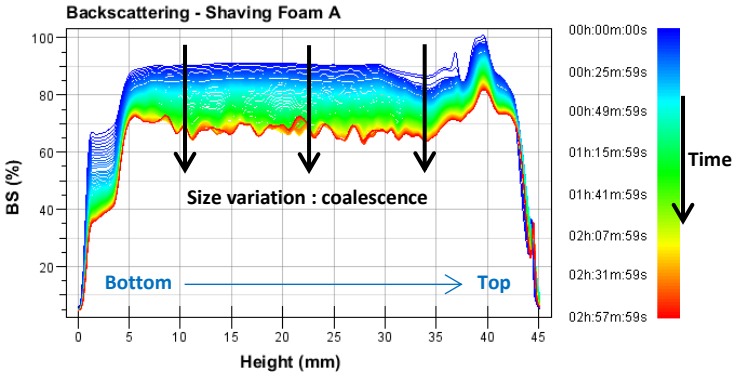

Figure 1: Backscattering variation for shaving foam A

From the graph in Figure 1, we can observe a global decrease of the intensity of backscattering over the time of analysis, this translates a size increase of the air bubbles over time. The air bubbles coalesce together to form bigger ones. In order to characterize the different shaving foams, the following parameters are computed:

- The global stability
- The kinetics of bubble coalescence

2. The global stability

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 (coalescence, clarification, liquid drainage, …). At a given ageing time, the higher the TSI, the worse the stability of the sample.