

Settling particles speed *via* Turbiscan and Lumifuge

Application

Determining the shelf-life via particles speed monitoring

Objective

Determine if applying a mechanical stress (centrifugation) enables the determination of a “real” particles speed in the samples and compare experimental results to theory (Stokes Law) and Turbiscan results

Method

Testing the same samples with Turbiscan and Lumifuge, and compute the theoretical results *via* the Stokes Law.

Introduction

We have already studied the effect of centrifugation on prediction of shelf-life, and seen that less than 15% of the predictions were in accordance with the real shelf-life of the products (see Technical Note : Impact of centrifugation on stability study)

One of the key arguments generally given in response to these results, and in favour of the centrifugation, is that it works particularly well for Newtonian products (solid dispersions with a reasonable concentration, diluted emulsions, etc...). It should then be possible to monitor the particles speed in such products, and compare it to the theoretical prediction of the particles behaviour computed thanks to the Stokes Law, which drives the speed of these objects.

The purpose of this technical note is to compare the speed of particles that the user can determine experimentally from Turbiscan and Lumifuge data to the theoretical values computed from the Stokes Law.



Fig. 1 – Turbiscan LAB and Lumifuge

Measurement Protocol

Three samples are studied, all based on a continuous phase containing 50/50 wt. water and glycerol, but with various concentration of titanium dioxide:

- 0.05% wt. $\text{TiO}_2 \rightarrow 0.01\%$ vol. TiO_2
- 0.15% wt. $\text{TiO}_2 \rightarrow 0.04\%$ vol. TiO_2
- 0.50% wt. $\text{TiO}_2 \rightarrow 0.12\%$ vol. TiO_2

The experiments are carried out at the room temperature (25°C), giving the following properties to our samples:

- Continuous phase viscosity : 5.3 cP ;
- Continuous phase density : 1115 kg.m^{-3} ;

The titanium dioxide (TiO_2) which is used in these samples has the following properties:

- TiO_2 diameter : $0.9 \mu\text{m}$;
- TiO_2 density : 4230 kg.m^{-3} ;

The products were then analysed with the Turbiscan (5 hours) and the Lumifuge, at three centrifugation speeds (30 G, 290 G, 1150 G) in order to extrapolate the particles speed under normal gravity, which is the recommended method explained in the Lumifuge User Guide.