TURBISCAN

Stability mapping using the TSI
Formulation optimization

INTRODUCTION

Suspensions are unstable colloidal systems that undergo many destabilization phenomena (sedimentation, flocculation, creaming, etc.) that can be due to various causes (viscosity, particle size, attractive forces, etc.). Therefore, it may be complex for the formulator to determine the origin of these processes to be able to overcome them and to get a stable product.

One of the strategies to avoid these destabilization phenomena is to increase the viscosity of the formulation. The purpose of this paper is to determine the effect of increasing polymer concentration in a simple dispersion of TiO2 in different mixtures of glycerol and water.

Optimization | **Design of Exp.** | **Fast**

Measurement Protocol

16 samples were studied, adjusting the formulation with various ratios:

- Ratio glycerol / water: 0 / 0.33 / 0.66 / 1
- Xanthan concentration: 0 / 0.05 / 0.1 / 0.2
- 0.50% wt. TiO2

Identification of Phenomena

Thanks to the Turbiscan device, destabilization phenomena were identified in all formulations.

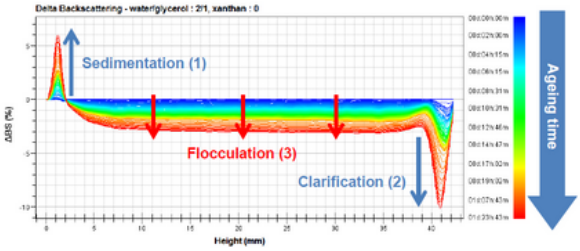
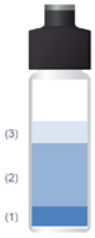


Figure 1: Delta Backscattering, water/glycerol: 2/1, xanthan: 0



The graph above can be separated into 3 parts to understand the phenomena:

- At the bottom (1), BS signal increases because the concentration increases ;
- At the top (3), BS signal decreases because the concentration decreases ;
- In the middle (2), BS signal evolves, because of the size variation ;

Qualification of Phenomena

It is possible to rank the stability of the samples, depending on the composition ([xanthan], [glycerol/water]), thanks to the TSI as shown below.

TSI sums all the variations detected in the samples in terms of size and/or concentration. The higher is the TSI, the worse is the stability.

As shown below, it is possible to plot a stability diagram, representing the stability (TSI), as a function of the product formulation.

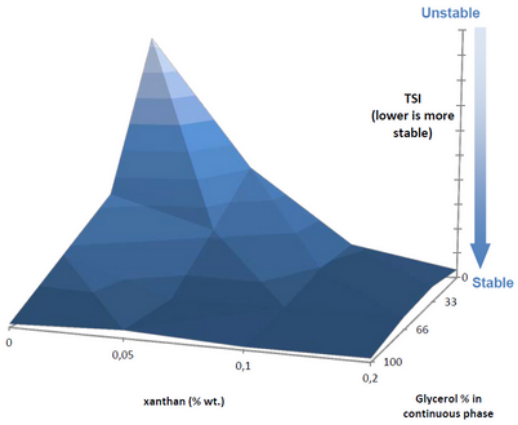


Figure 2 : Delta Backscattering, water/glycerol: 2/1, xanthan: 0

As expected, the stability of these dispersions is improved by:

- Increasing the viscosity of the continuous phase, simply by adjusting the ratio between glycerol and water ;
- Adding xanthan to the continuous phase, another way to increase its viscosity, thus slowing down the migration of the particles.

It is also noticeable that the optimal stability is obtained for the samples containing more than 0.1% of xanthan and more than 66% of glycerol in the continuous phase.

CONCLUSION

The Turbiscan enables to qualify the best formulation in terms of stability. This is possible in every kind of concentrated dispersions without any dilution.
The Turbiscan is also a unique tool for monitoring the kinetics of destabilization of the system, and quantify it precisely after identifying the phenomena.