Formulaction
Smart scientific analysis

TURBISCAN LAB

Emulsification

- Online optimization of the formulation process –

PROCESS

Introduction

Setting up the right process for emulsification requires high level of expertise to select the right tools (mixing blades & homogenization type), parameters (speed and time…). Efficiency of the processes is usually studied by particle size measurement using size analyzers set externally to the whole process. This requires tedious back and forth sampling and preparation for the instrument, limiting the analysis of full kinetics. Turbiscan®, the leading technology in direct stability measurement, provides a fast and pragmatic approach for such measurement thanks to the T-LOOP module.

KEY BENEFITS

ONLINE

NO DILUTION

FAST

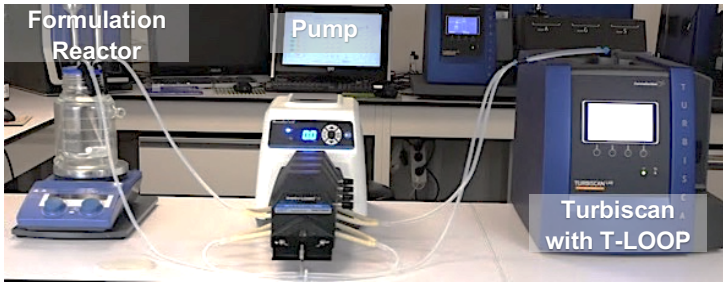
How it works

Turbiscan technology, based on Static Multiple Light Scattering (SMLS), consists on illuminating a sample with an infrared light source and acquiring backscattered (BS) and Transmitted (T) signals.

$$\boldsymbol{BS\ and\ T} = \boldsymbol{f}(\varphi, \boldsymbol{d}, \boldsymbol{np}, \boldsymbol{nf})$$

The signal is directly linked to the particle's concentration (φ) and size ($\boldsymbol{d}$) according to the Mie Theory, with refractive index of continuous ($\boldsymbol{nf}$) and dispersed phase ($\boldsymbol{np}$) being fixed parameters. The measurement of the BS and T can be performed either on scanning mode, to provide homogeneity and stability measurement, or with very high frequency for fast time resolved and online measurement.
The measurements are done without any dilution & on native sample.
Additionally, the Turbiscan can be associated with 2 dispersing tools allowing to increase its capabilities:

- T- MIX for automated fast formulation screening with a stirring bar directly inside the measurement cell. **(**see Notes Flow 1-3).
- T-LOOP for online measurements and scale up or process optimizations. **Subject of this note**.

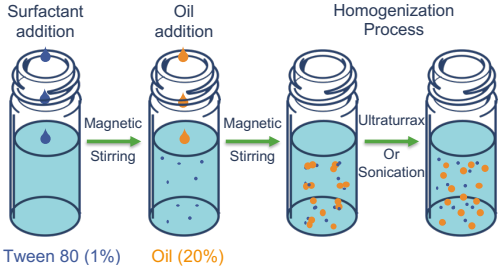


Experiment and method set up

<u>The aim of the work:</u> Study of the efficiency of two different homogenization methods: Sonication (US) and industrial disperser (Utraturrax - UT)

<u>The emulsion type:</u> 20% O/W emulsion stabilized with 1% tween 80.

<u>Sample preparation:</u> Surfactant is mixed with water. The oil is added to the water/surfactant solution under magnetic stirring for 2 min to create a premix. The pre-mix is homogenized at different amplitudes and speeds for 15 minutes:



<u>Sample analysis:</u> The measurement of the BS and T is directly during the homogenization using the **T-LOOP module**: The emulsion is pumped in and out the Turbiscan cell thanks to a peristatic pump, creating a circulation loop with the formulation "reactor".

This online setup gives a direct access to a determination of native particle size under mixing. No sampling is required, and the data can be acquired up to 10 times per second. This ensures a real monitoring of the particle size evolution (droplet size, particle reduction) without any dilution nor external forces.