DIRECT MEAN SIZE MEASUREMENT IN NATIVE CONCENTRATED DISPERSIONS WITH STATIC MULTIPLE LIGHT SCATTERING

INTRODUCTION

Nano and micro suspensions or emulsions are widely used in the industry but their real dispersion state remains unknown or not well characterized in their native and concentrated form. Indeed, it is well known that aggregation and agglomeration may exist in concentrated regime.

Static Multiple Light Scattering (S-MLS) is a well-adapted technique to determine samples mean diameter without dilution and external stress, which could modify their real state. Common measurement techniques may alter the size due to the principle of measurement (microscopy, centrifugation, FFF, sieving, filtration) or the sample dilution (DLS, PTA, laser diffraction). This is especially the case for samples containing agglomerates which may breakdown because of measurement conditions such as shear stress (pumping, flowing, filtration, and centrifugation) or heavy dilutions.

Here we propose to use the SMLS technique principle to assess the mean particle size and to highlight the range of analysis of this method and its assets.

METHOD

Static Multiple Light Scattering technology (SMLS)

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

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

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

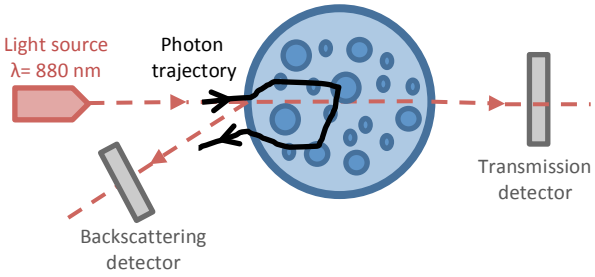

Figure 1 : Schematic representation of Turbiscan device

knowing refractive index of continuous (n_f) and dispersed phase (n_p) and the particles concentration (φ).

The mean diameter is given with an accuracy of +/-5% on a concentration range between 10^{-4} and 95% and for a size range between 10 nm and 1000 µm.

MATERIALS & RESULTS

A large samples panel in terms of refractive index, concentration and size was analyzed with the device. These samples correspond to industrial samples. Their characteristics are described in the table next page.