Formulaction
Smart scientific analysis

TURBISCAN LAB

Nanoparticles and toxicity

- Establishing more detailed protocol for fate evaluation -

RAW MATERIALS

Introduction

While nanoparticles (**NPs**) are massively released in the environment and consumed by humans in food products, there is a growing concern of a potential hazard of NPs on human health. To assess the NPs toxicity in in-vitro studies, NPs are dispersed in cell culture media and this dispersion is dispensed to cells. However, when dispersed in cell culture media, NP's can undergo many physical destabilizations, e.g. agglomeration and sedimentation. These NPs-media specific interactions are of paramount importance to understand the NPs fate, transport and exposure dose delivered to cells. Hence, to obtain reliable dose-size/cytotoxicity responses, it is mandatory to control NPs size, dispersibility and stability. In this application note, we demonstrate how Turbiscan® device allows to accurately characterize these unique dispersions prior to toxicological studies.

KEY **BENEFITS**

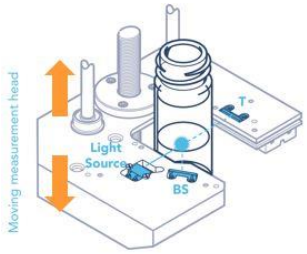
FAST

NO DILUTION

SENSITIVE

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 over the whole sample height.
By repeating this measurement over time with adapted frequency, the instrument enables to monitor physical stability. The signal is directly linked to the particle concentration (φ) and size (d) by the Mie theory knowing refractive index of continuous (n_f) and dispersed phase (n_p):



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

Materials & Method

The NPs dispersion preparation was performed in two steps following the NANoREG protocol:

1. NPs batch dispersion was prepared: TiO_2 P25 (Evonik - primary size 21nm) NPs were added to previsouly prepared sterile-filtered BSA-water dispersion to obtain a final NPs concentration of 2.56mg/mL. The resulting dispersion was then sonicated during 16min.
2. The batch dispersion was diluted in DMEM to obtain a final NPs concentration of 0.256mg/mL (diluted 10 times).

Because BSA plays a preponderant role in the dispersibility and stability of NPs in cell culture media, five batches with 0%, 0.05%, 0.1%, 0.2% and 0.5% BSA mass fraction were considered.
The NPs mean particle size, state of agglomeration, sedimentation rate and concentration kinetic have been all evaluated with the Turbiscan® at room temperature.

Results

Initial mean size of the NPS in cell culture media

The initial TiO_2 NPs mean size has been measured for dispersions with different mass fraction of BSA in DMEM, see Figure 1

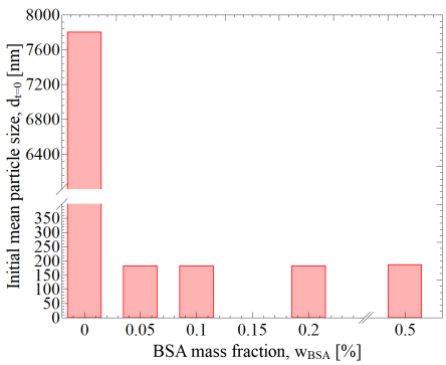


Figure1: Initial mean size of TiO_2 NPs in DMEM for various BSA mass fraction