



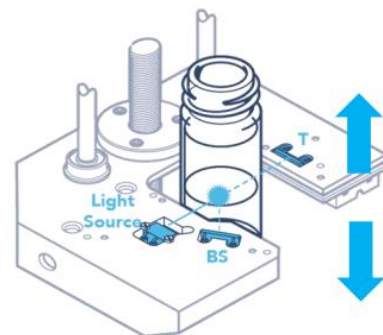
# DETECT STABILITY UP TO 1,000× FASTER WITH TURBISCAN

## Context

Stability is a key parameter in formulation development, directly impacting product quality, shelf life, and performance in industries such as pharmaceuticals, food, and cosmetics. Unstable formulations can separate, sediment, or degrade, leading to product failure and customer dissatisfaction. Conventional visual tests for stability are slow and subjective, often requiring weeks to observe changes and risking missed early signs of instability. Accelerating this process is crucial for efficient formulation screening and quality control. The TURBISCAN addresses these challenges by providing rapid, objective, and highly sensitive stability analysis, delivering results up to 1,000 times faster than traditional visual methods.

## TURBISCAN: How it works

**TURBISCAN technology**, based on Static Multiple Light Scattering, consists on sending a light source (880 nm) on a sample and acquiring backscattered (BS) and transmitted (T) signals all over the height of a sample. By repeating this measurement over time at an adapted frequency, the instrument enables to monitor physical stability. The signal is directly linked to the particle concentration ( $\phi$ ) and size (d) according to the Mie theory:



$BS \text{ and } T = f(\phi, d, n_p, n_f)$

## Stability test by visual observation

Visual observation, while widely used, presents significant limitations for stability assessment

- **Slow:** Visual assessment relies on detecting changes with the naked eye, so early signs of instability are missed. By the time differences are visible, destabilization is already well advanced, often requiring **weeks** or even **months** to observe.
- **Operator-Dependent:** Results vary from person to person, as interpretation is subjective and influenced by individual experience and perception. This leads to inconsistent and non-reproducible data.
- **Not Quantitative:** Visual observation provides only a general impression of stability. It is difficult to measure the extent of destabilization or objectively compare samples, limiting its usefulness for formulation optimization.

## TURBISCAN vs Visual observation

TURBISCAN technology dramatically accelerates stability testing by combining advanced detection methods and precise measurement control:

- **Superior Sensitivity:** Unlike the human eye, TURBISCAN uses high-resolution backscattering and transmission detectors. These sensors can detect minute changes in particle concentration or size at the earliest stages of destabilization, long before any visible signs appear.
- **High precision Mechanics:** The instrument features highly accurate mechanical systems for sample scanning, including precise head displacement and photon collection at micrometer-scale steps. This ensures detailed, reproducible analysis along the entire sample height.
- **Real-world testing, real-life results:** Measurements are carried out on undiluted samples placed in standard cylindrical glass vials, with precise temperature control. This approach closely replicates actual storage, shipping, and usage conditions, delivering reliable and relevant stability data.

TURBISCAN delivers stability results up to 1,000 times faster than visual observation. Is it possible? Do you have examples? Here's how the technology makes rapid, early detection of instability a reality.

## 1,000 time faster than visual observation

The time-saving factor offered by TURBISCAN can vary depending on the formulation type, as different suspensions and emulsions exhibit unique destabilization behaviors. It also depends on the visual acuity of the observer and the visibility of the destabilization phenomena. Based on over 30 years of experience, we typically observe detection times that are **hundreds of times** faster than visual observation, and in some cases, even greater acceleration is achieved.

But how effective is TURBISCAN technology for the early detection and quantification of destabilization?

Based on internal studies, we have evaluated the time required to detect destabilization in **dispersions** using visual observation versus TURBISCAN. These results have been detailed and validated in a scientific publication (see reference below).

## Results

TiO<sub>2</sub> suspensions in water were tested at different concentrations. Stability was assessed using the TURBISCAN and a camera setup to record visual signs of destabilization. The table below presents the time (in minutes) required to detect the first signs of destabilization with TURBISCAN compared to the camera (serving as a proxy for "visual observation").

TiO <sub>2</sub> conc m/v	TURBISCAN detection time	visual detection time	Acceleration factor
1%	1,3 min	240 min	192
2%	3,7 min	720 min	192
5%	6,7 min	>43200 min*	> 6480
10%	7,5 min	>43200 min*	> 5760

\* After two weeks of camera inspection, visual inspection was performed manually for three more weeks without seeing any change

The ability to detect destabilization, whether by TURBISCAN or visual observation, depends on the specific formulation (here we change the TiO<sub>2</sub> concentration). As demonstrated in this study, TURBISCAN is highly effective, allowing detection of destabilization significantly earlier than visual observation—ranging from approximately **200** to **6,000** times faster.

In real-world applications, the time required to observe instability using traditional visual methods typically ranges from days to several months—whether dealing with food emulsions like mayonnaise and dairy drinks, pigments in inks and paints, cosmetic creams and lotions, or

pharmaceutical suspensions and injectables. These conventional assessments often rely on prolonged shelf life studies or storage periods, delaying time to market or validation of a production batch. Thanks to its high sensitivity and quantitative measurements, TURBISCAN dramatically reduces the timeline for stability characterization, allowing formulators to detect even minor changes within **hours or days instead of weeks or months**. This acceleration supports faster formulation screening, reliable quality control, and efficient product development across the food, ink, cosmetic, and pharmaceutical industries, resulting in higher-quality products and more agile innovation processes.

## Conclusion

There is a significant advantage of TURBISCAN technology over traditional visual observation for stability assessment. By offering rapid, quantitative, and highly sensitive detection of destabilization phenomena, TURBISCAN enables users to identify early signs of instability **hundreds to thousands** of times faster than conventional methods. This accelerated analysis not only reduces development timelines and enhances formulation screening but also ensures more robust quality control throughout the product lifecycle, removing operator interpretation from visual observation. As a result, TURBISCAN stands out as a critical tool for researchers and manufacturers seeking to optimize product stability, improve efficiency, and maintain the highest standards of quality in the formulation of suspensions and emulsions.

## Reference

M.Sentis, et al. "Numerical prediction of long-term stability of liquid formulations determined by visual observation and static multiple light scattering"



# TURBISCAN RANGE

The world leader in Stability & Dispersibility Analysis