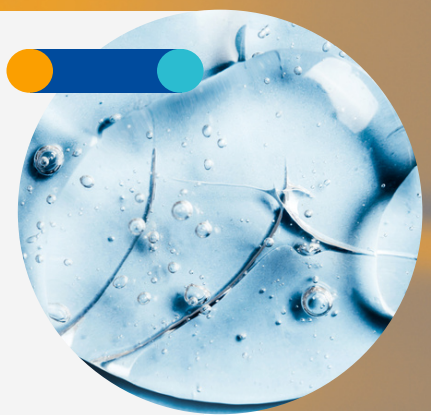
TURBISCAN® DNS

Polymer solubilization monitoring for better product stability

INTRODUCTION

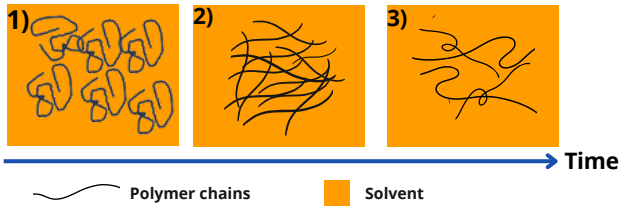
Polymers are valuable ingredients for various applications such as coatings/adhesives, pharmaceuticals, cosmetics... They play a major role in the final product texture, stability, encapsulation, film formation...
The polymer dissolving process is called polymer solubilization, and a complete solubilization is essential to enhance dispersibility, emulsification ability, and particle suspension. Many factors impact the solubilization step and there is no official methodology or technique to quantify it.
This application note presents different polymer solubilization studies with the TURBISCAN® DNS enabling characterization and quantification of the polymer solubilization to enhance final product stability.



Natural polymers **Green solvents** **Screening**

Polymer solubilization

Polymer dissolving process into a solvent is referred to as polymer solubilization and usually corresponds to the very beginning of the formulation. The process can be simplified in these 3 steps :



1) First addition of polymer particles into a solvent (solid state)

2) Then swelling of polymers

3) Finally polymers are completely solvated into the solution, if the solvent is the ideal one, for a **HOMOGENEOUS** solution

To get a homogeneous solution, many factors impact the solubilization step:

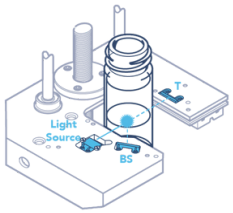
- **Polymer**: chain length, molecular weight, functionalization... Synthetic polymers (for coatings, resins...) or natural ones (plant proteins, cellulose...).
- **Formulation parameters**: solvent, pH, ionic strength...
- **The process**: impact of the temperature, mixing time...

Polymer complete solubilization is key for final product homogeneity and for the final performance and stability.
It's essential to enhance dispersibility, emulsification efficiency, adherence, prevent settling, and targeted control release...
On top of that, there is no official methodology or technique to characterize or quantify this ability.

The Turbiscan® DNS, with its mixing capabilities on native samples, offers the possibility to measure solubilization, select the right polymer, and optimize the process to enhance final product stability and performance.

TURBISCAN®: HOW IT WORKS

Turbiscan® technology, based on Static Multiple light scattering (SMLS), consists of illuminating a sample with an infrared light source and acquiring Backscattered (BS) and Transmitted (T) signals.



BS and T = f(φ, d, np, nf)

φ: particle concentration
d: particle diameter
np: dispersed phase refractive index
nf: continuous phase refractive index

The signal is directly linked to particle's concentration (**φ**) and size (**d**). Measurements can be performed at high frequency for fast time-resolved and online dispersibility measurement or on scanning mode, to provide homogeneity for stability measurement. Samples are studied in native state up to 95% V/V and for particle size measurement from 10nm up to 1mm. The Turbiscan®DNS (Dispersibility and Stability) is composed of 2 modules.

- **T-MIX:** measure particle dispersion directly inside the measurement vial with a stirring blade (mixing speed up to 2000 rpm).
- **T-LOOP:** measure online dispersibility from your process with a peristatic pump creating a Loop and/or optimizing your dispersion process.

The following illustration shows the measurement principle: SMLS technology combined with the T-MIX module.