Stability analysis for different grades of Micro-fibrillated Cellulose (MFC)

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RAW MATERIALS

Introduction

Nano-scale cellulose fibre materials (e.g., Micro-fibrillated Cellulose) serve as a promising candidate for bio-based materials from a sustainable resource thanks to their abundance, high strength and stiffness, low weight and biodegradability.

Micro-fibrillated Cellulose is obtained from a fibrillation process in water which converts cellulose fibres into a volume spanning three-dimensional network of micro fibrils. As a result, a robust product with interesting rheological properties is formed. It is well adapted for application fields such as cosmetics, food, coatings, cements, agrochemicals and nanocomposites...

Characterization of fibrillated celluloses however, remains challenging due to its heterogeneous nature. MFC mostly consist of long, slender fibril aggregates with a high degree of branching. Fibrillated celluloses contain fibrils and fibril aggregates with different dimensions and thus their proper assessment requires methods adapted for multi-dimensional analysis.

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):

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

Method

Three water-based suspensions of micro-fibrillated cellulose (MFC) were analysed at the room temperature for 8 days. The size of fibrils and their aggregates are rather distributed with filamentous and branching shape:

- Width: from a few nanometres up to a few micrometres
- Length: approximately 100 times greater than the diameter according to preliminary SEM studies.

The table below gives the details of size and concentrations:

Sample	A	B	C
Fibre width	few micrometers	sub-micrometers	nanoscale range
Concentration	0.017%wt	0.123%wt	0.012%wt

Table 1: Sample description

Results

Raw data

Figure 1 illustrates the delta-transmission signal for the three samples as a function of the sample height over time (from blue to red curves).

The Turbiscan® profiles for sample A and B display an increase at the top of the sample (right part of the graph) and a decrease at the bottom of the sample (left part of the graph). It means that the concentration of scatterers is increasing from the top to the bottom of the sample – sedimentation is occurring.

In other words, particle migration is occurring causing the sample clarification at the top of the sample...