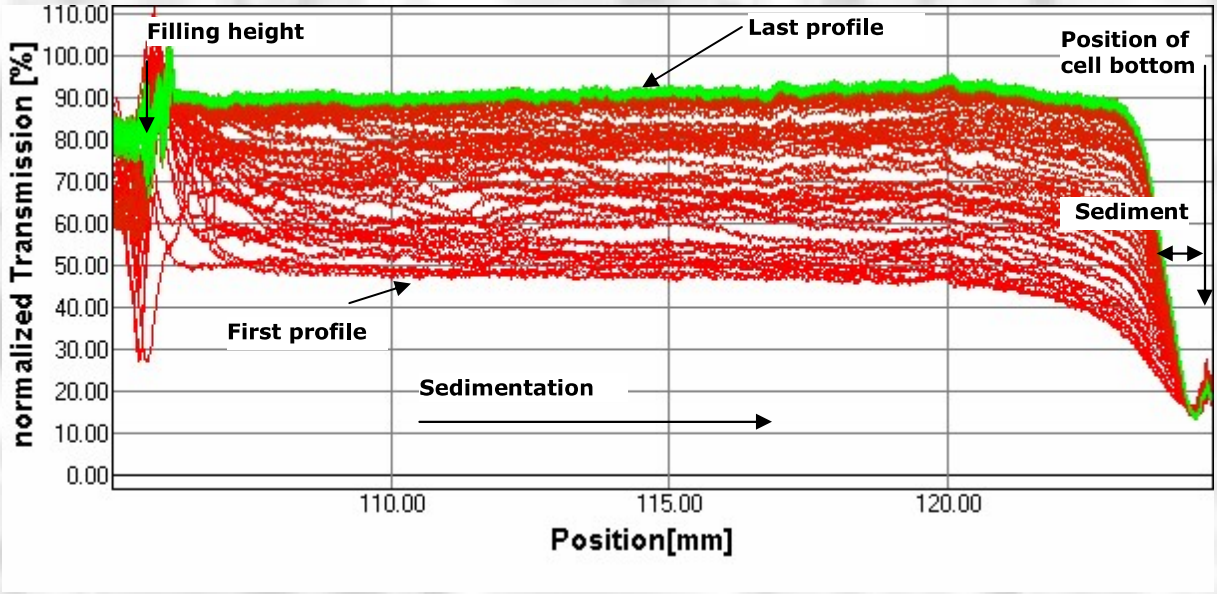
APPLICATION NOTE
CELLULOSE DISPERSIONS – PULP & PAPER

Particle size distribution of Cellulose dispersions according to ISO 13318-1 and ISO 13318-2

Introduction

For the production of high grade specialty papers the economic and effective use of cellulose and chemical additives is desired under the condition to achieve the required or even an improved paper quality. A significant potential for the optimization of the raw material charge is given in the quantification of the interactions between the components of the stock suspension and their sedimentation behaviour, and especially between short-fibre and long-fibre pulps with varying fines content.
Particle size analysis is conducted by multisample analytical centrifugation, based on STEP®-technology, according to ISO 13318. The measurements with the Dispersion Analyser LUMiSizer® provide reliable parameters for quality control and process optimization.

Measurement



Cellulose dispersion A diluted to 0.05%, Evolution of transmission profiles with stepwise increase of centrifugal acceleration from 36-2300 xg for the detection of the entire particle size range, at 7°C.

The particles in dispersion A move with different speed, a polydisperse sedimentation is observed. Polydisperse sedimentation is characteristic for colloidal stable dispersions (stable against particle aggregation). This is a prerequisite for obtaining the particle size distribution from sedimentation measurements.

On the basis of two analysis modi different distribution types are calculated from one measurement:

1. "Constant position" –concentration detection over time at one position and
2. "Constant time" – concentration detection over the entire sample length at least for one time.

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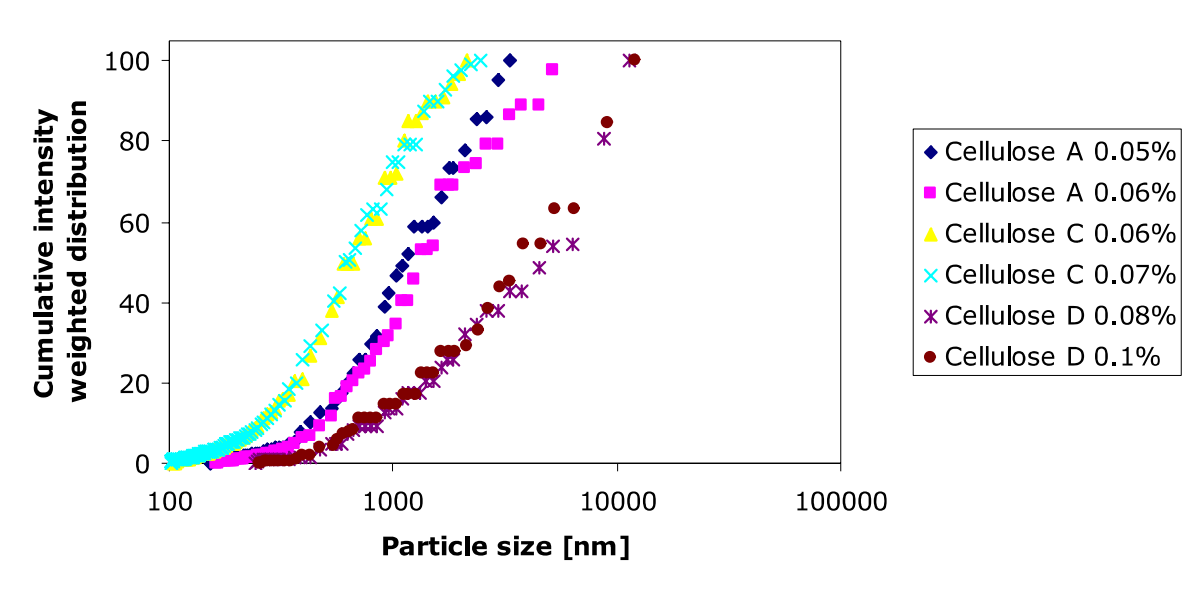
Results

The cumulative intensity weighted particle size distributions, calculated according to ISO 13318, derived by analysing the time course of transmission at the constant position of 121 mm (near the cell bottom) are shown in the following figure.



Cumulative intensity weighted particle size distribution of different cellulose

Summary

All samples have a very broad particle size distribution as expected from the shape of the transmission profiles. Dispersion C features the smallest particles (100 to 2000 nm), D the largest particles (300 - 11000 nm). Repeat determination for different concentrations proves the excellent reproducibility. The differences found in the particle size distribution are in good agreement with the separation kinetics of these samples (see references).

Within the analysis protocol of SEPView® software further details, including measurement protocol, different distribution types, harmonic mean values, standard deviations, fit functions etc. are provided.

References

- Sedimentation behaviour of Cellulose dispersions, Influence of particle particle interactions, Application note L.U.M. GmbH
- STEP-Technology see www.lum-gmbh.com/pages/technology.htm
- Particle Size Distribution by Space or Time Dependent Extinction Profiles obtained by Analytical Centrifugation, T. Detloff, T. Sobisch, D. Lerche, Part. Part. Syst. Charact. 23 (2006), 184-187