APPLICATION NOTE
CELLULOSE DISPERSIONS – PULP & PAPER

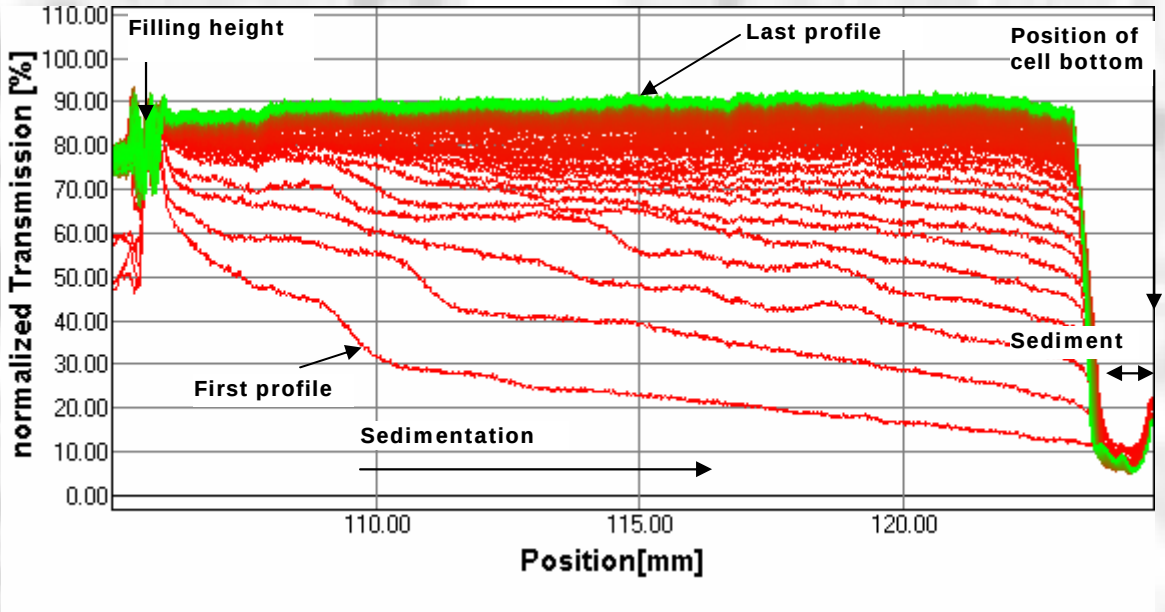
Sedimentation behaviour of Cellulose dispersions
Influence of particle particle interactions

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.
Multisample analytical centrifugation, based on STEP®-technology, is suitable for the qualitative and quantitative characterization of the sedimentation behaviour of different cellulose dispersions, as shown in examples below.

1. Fingerprinting of the dispersions – Different sedimentation types

Polydisperse sedimentation – Cellulose dispersion A



Cellulose dispersion A, Evolution of transmission profiles with time at 2300 xg, 20 °C.

The separation process is characterized by a very polydisperse sedimentation (no sharp front), particles move with different speed. During storage segregation may occur (sedimentation of larger particles or solids with higher density). Under the applied conditions most of the large particle fraction has already sedimented when recording the first transmission profiles, see low transmission zone near the cell bottom. The detailed analysis of this fraction is possible with a measurement at low g-force, e.g. ≥6xg. Applying the above conditions fine particles are separated with different speed (broad distribution of fine fraction).
Polydisperse sedimentation is characteristic for colloidal stable dispersions (stable against particle aggregation).

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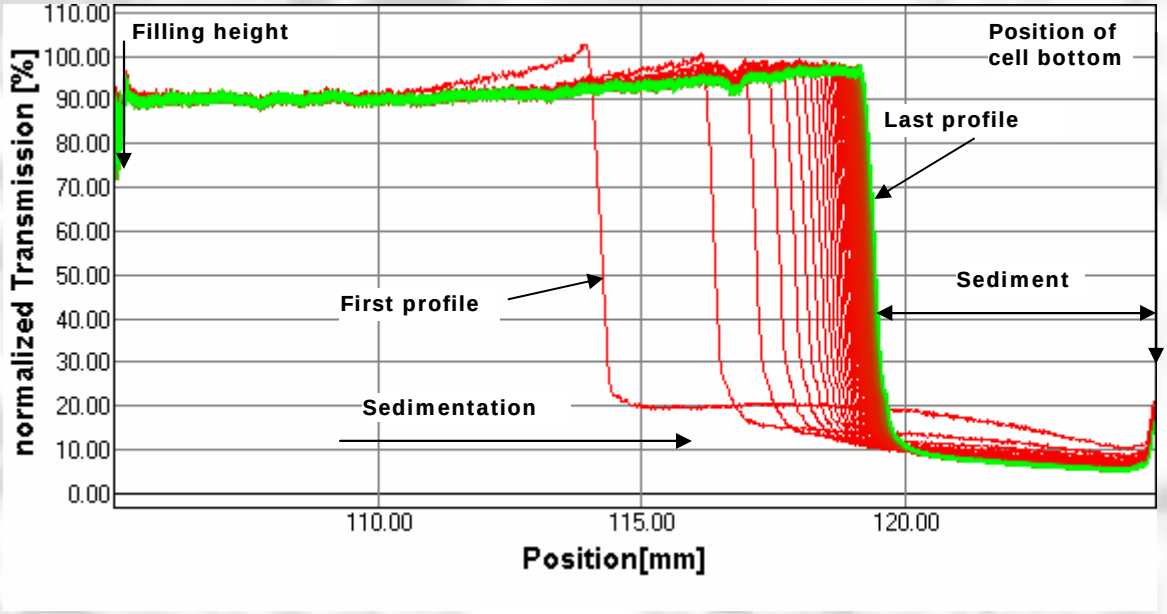
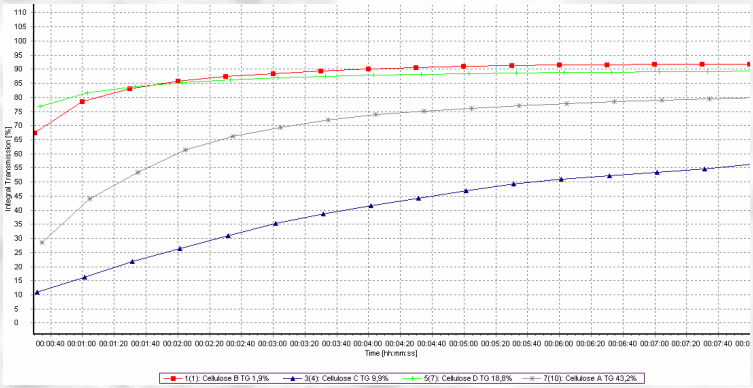
Zone sedimentation – Cellulose dispersion B



Cellulose dispersion B, Evolution of transmission profiles with time at 2300 xg, 20 °C.

The evolution of the transmission profiles characterizes a zone sedimentation and a closed (flocculated) particle network. All particles move with nearly the same speed. The space between the consecutive profile decreases, the resistance against further compaction is increasing. The degree of sediment compaction can be determined during one measurement with different centrifugal forces (different rotor speeds), it reflects a parameter for the further processing of the cellulose dispersion.

2. Fast ranking of demixing stability by Integral Transmission



Separation kinetics (Change of transmission with time)
for the range 107 – 119 mm, at 2300 xg, 20 °C

The cellulose dispersions A, C, D differ in their solid content (TG) only, Sample B has a different chemical composition.
The higher the slope within the initial range of the Integral transmission curves <5 min, the higher the clarification speed of the sample.
The *blue* sample C is the most stable dispersion against demixing, in contrast to the other samples the sedimentation has not been finished yet.
The same differences were found in the particle size distributions for these samples (see references).

References

- Particle size distributions of Cellulose dispersions according to ISO 13318-1 and ISO 13318-2, Application note L.U.M. GmbH
- STEP-Technology see www.lum-gmbh.com/pages/technology.htm
- Charakterisierung von Wechselwirkungen in Faserstoffsuspensionen über die Verfolgung des Sedimentationsverhaltens, K. Erhard und K. Frohberg, PTS-Forschungsbericht www.ptspaper.de 21.06.2004, www.ptspaper.de/live//dokukategorien/dokumanagement/psfile/file/65/AiF_1345440ffd27c5d54e.pdf
- Einfluss der Porenstruktur des Rohpapiers auf das Streichergebnis von LWC-Papieren, M. Hucke und S. Schnabel, ipw 11/2004, p 44-48, http://www.ipwonline.de/download/zellchem/2004/dp110404.pdf