

Sedimentation and consolidation behaviour of flocculated versus non-flocculated dispersions: A reliable laboratory test

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During technical application and during solid-liquid separation dispersions are often flocculated. While during application sedimentation and consolidation usually have to be avoided or minimized, for solid-liquid separation these are essential. In both cases there is a need for fast reliable methods for comprehensive characterization of these processes. Often the value of zeta potential is employed to judge the stability state in the sense of flocculated versus non-flocculated dispersions, but especially in case of sterically or rheologically stabilized dispersion this approach is often not applicable.

Analytical centrifugation based on Space and Time resolved detection of Extinction Profiles of electromagnetic waves (STEP-Technology) over the entire sample height was used to characterize the nature of particle interactions and the degree of flocculation in dispersions at original concentration. Photometric and x-ray measurements were carried out.

Investigations on sedimentation and consolidation behaviour of flocculated polydisperse suspensions of different suspensions made from titanium oxid, magnetic therapeutic carrier particles, quartz or lime stone are presented to demonstrate the procedure. Colloidal stable dispersions (stable against flocculation, agglutination) show a typical polydisperse sedimentation behaviour, whereas flocculated dispersions exhibit zone sedimentation and gradual consolidation. While the packing density (sediment height) for colloidal stable dispersions does depend only slightly on the excess pressure acting on the sediment it strongly depends on pressure for flocculated dispersions and it takes much longer to reach the corresponding equilibrium height. Instead of carrying out measurements at different accelerations it is also possible to evaluate the compressibility of sediments (or cream layers) by increasing the acceleration step-wise and recording the kinetics of the sediment (cream layer) height or packing sediment concentration. It could be shown that in all investigated suspensions the state of flocculation was correctly classified even at very high concentration but e.g. in case of polymer stabilized magnetic microparticles high zeta potential (50 mV) would lead to false "non-flocculated" classification.

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Bio Sketch

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Thesis: "Mass Transport Across Artificial Membranes with Regard to Diffusion Layers"

Scientific Research Fields:

Particle characterization, Sedimentation and Consolidation of Dispersions, Colloid Chemistry, Cell Mechanics, Blood Rheology, Fluid Dynamics (more than 200 peer reviewed papers, numerous granted patents)

Business Activities:

- 1994 - Founder and Managing Director of L.U.M. Gesellschaft für Labor-, Umweltdiagnostik & Medizintechnik mbH (L.U.M. GmbH, Berlin, Germany, www.lum-gmbh.com)
Innovativ analytical instruments for comprehensive dispersion analysis
- 2003 - Formation and Managing Director of the biotec company Dr. Lerche KG as a spin-off from the L.U.M. GmbH (www.lerche-biotec.com)
- 2005 - Founder and Director of board of the daughter company LUM Corp., Denver, Co. (www.lumamericas.com)

Memberships (current):

- ISO-TC 24/Sc4*: Convener of working group 2 "Particle sizing by sedimentation methods"
Convener of working group 16 "Characterization of particle dispersion in liquids"
*Particle Characterization and Particle Measurement
- Board of Editors: Int. Journal "Biorheology" (IOS Press)
- VDI-GVC*: Subject Division "Rheology"
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