LUM

The NEXT STEP™ in Dispersion Analysis
& Materials Testing

Separation Analyser

LUMiReader® PSA

designed by Colans

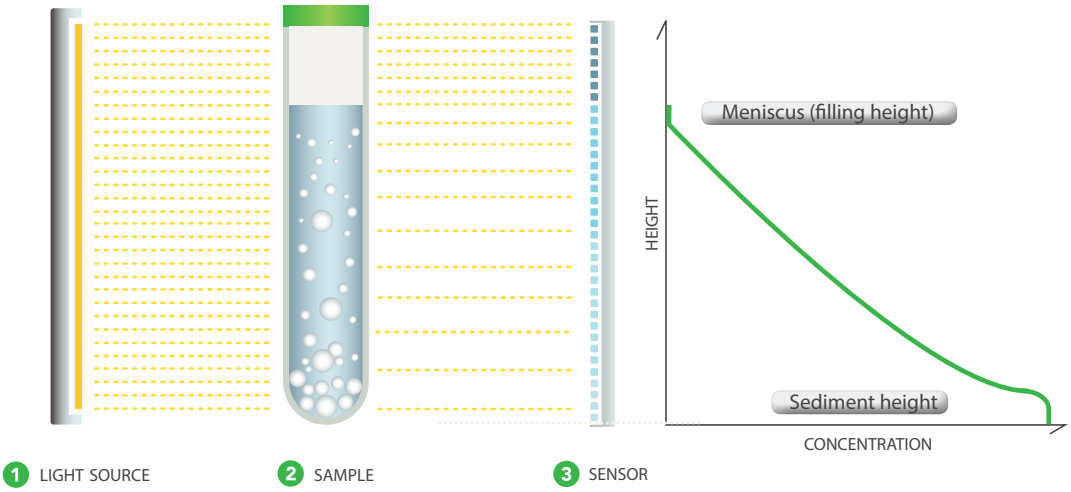
Going places the naked eye never could.

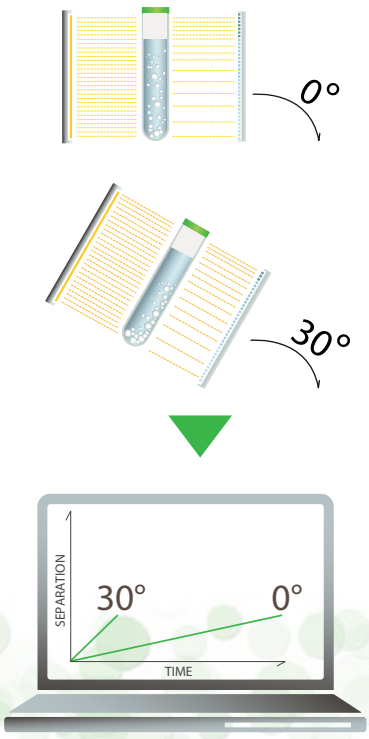
Particle size distribution | Density | Rapid separation | Long-term instability | Dispersibility | Accelerated Aging | Crystallization

LUMiReader® PSA uses

STEP TECHNOLOGY

Allowing you to have a look at the whole sample at once.





Full scientific reference:
https://bit.ly/2kO0PAq

The multi-wavelength Separation Analyser LUMiReader® PSA, enables you to accurately measure the instability and real-time separation kinetics of your emulsion/suspension directly for a wide range of viscosities and concentrations. An external thermostat allows for high precision thermoregulation from 4 - 80 °C.

The analyser uses the patented cutting-edge STEP-Technology®, which permits to obtain **S**pace- and **T**ime-resolved **E**xtinction **P**rofiles over the entire range of your sample in situ (every second) with high accuracy. Parallel light [1] (near infrared, red and blue) illuminates the sample cell [2] and the transmitted light is detected by thousands of detectors [3]. Transmission is converted into extinction and particle concentration may be calculated.

With the advantage of looking at the sample from top to bottom instantaneously, you can observe and understand different stability/instability phenomena concurrently; for example, creaming, sedimentation, coalescence, aggregation and flocculation at original product concentration under normal storage conditions.

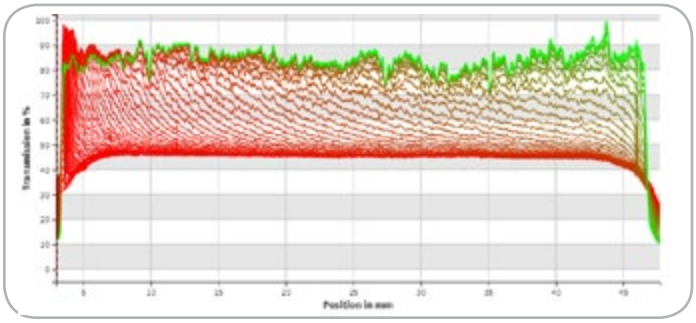
runs on

SEPView®

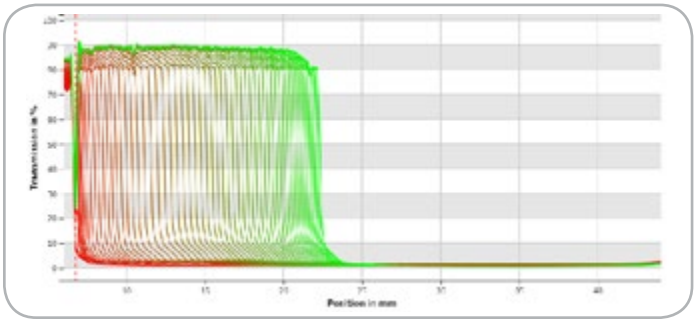
- Server-based, platform independent
- Plug & play, pack & go
- Real-time analysis during measurement
- Individual user customization
- Full SOP concept (Creation, capture, data analysis)
- Comprehensive database security & audit log
- easier handling by 3D visualization
- Complies with 21 CFR Part 11

- 10 different tools to understand (quantify) even the most complicated dispersions:

- Time lapse measurement replay
- Dispersion Fingerprint
- Instability index
- Clarification
- Phase separation
- Sedimentation & creaming velocity distributions
- First derivative of integral transmission
- Multi-wavelength extinction ratio
- Multi-wavelength particle size analysis
- ASTM D7827 module



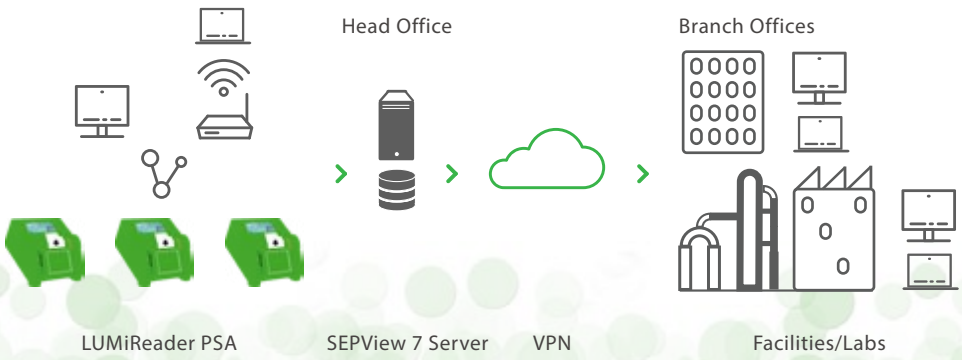
Lichrosorb (needles), polydisperse



Slurry, zone sedimention

Client-server architecture

The new client-server architecture of SEPView enables the use as a standalone solution as well as the seamless integration into your existing network infrastructure. All data are stored in a central database. In this way distributed real time collaboration becomes possible. Also measurements can be tracked, locally or spatially separated, in real time and analyzed at runtime.



The interactive, user-friendly graphical interface can be accessed platform-independently. The new user management allows to authorize users according to roles, groups or assigned projects. SEP-View of course supports different languages, intuitive search & filter criteria, import & export of data, an audit log, as well as comprehensive analysis tools.

Particle sizing & characterization

The measurement of particle size distributions of emulsions and suspensions plays a key role in development or process control in a variety of industries, e.g. chemical, pharmaceutical, food or cosmetic. Many product properties are correlated to the size of particulate components.

Frequently optical particle size measurement techniques are used to determine the volume weighted distribution. To this end the size and material dependent extinction coefficient is needed which can be calculated by Mie-theory using known complex refractive index of the particles. In this case strong assumptions have to be made like spherical homogeneous particles.

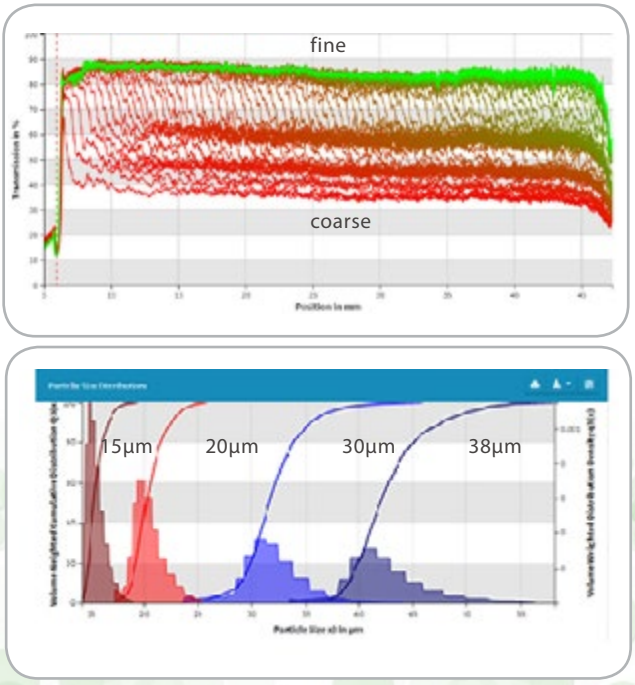
On the other hand, the experimental determination of the refractive index can be very difficult especially in the submicron range and for heterogeneous particles. No standard methods are available today.

The evaluation of space and time resolved extinction profiles for separating particles at different wavelengths can be used as alternative approach. The information on particle size distribution is then gained from sedimentation or creaming velocity and the wave length dependency of the extinction. The extinction coefficients and further the volume weighted particle size distribution can be calculated based on the differences between the profiles by algorithm described. It works reliably not only for spherical homogeneous particles but also for nonspherical particles.

Reference: https://bit.ly/2mqKbqU

Droplet size & particle size distributions

- Particle sizing for the whole sample: STEP-Technology
- True raw data – Direct physical measurement
- Same principle applied for nm to µm
- High resolution for multimodal systems
- Higher concentrations possible than for other techniques
- Closed sample cell – No restrictions for liquid continuous phase



Transmission profile and corresponding particle size distribution of 4-modal PMMA reference particles

Stability testing & separation analysis

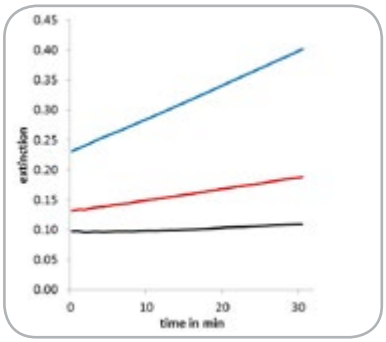
LUMiReader® PSA is used in countless applications for direct real-time stability testing and separation analysis of emulsions, suspensions, suspoemulsions and related products in their original concentration. The measuring temperature is selected according to the application and storage conditions from the large range between 4-80 °C. Advantages are reported for nano & microparticles, for unsteady particle systems like crystals and their agglomerates, fibres and flakes. A sample specific acceleration of the separation at gravity can be achieved by inclined settling, applying the Boycott effect. References: https://bit.ly/2mt2GuP & https://bit.ly/2kO0PAq

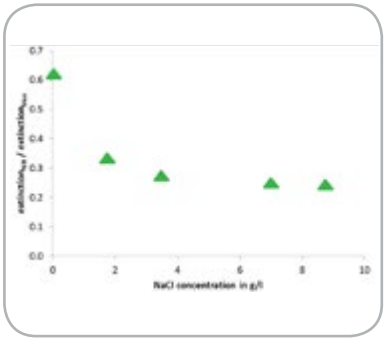
Aging, particle size & concentration change

LUMiReader PSA measures extinction profiles at different wavelength. This allows for the determination of changes in concentration and/or particle size. The differences at different wavelengths can be used for the comparison in product quality. Changes in particle size may result from flocculation, coalescence, etc.

From the separation velocity, the light attenuation and the signal differences at different wavelengths the extinctions coefficients and further the volume weighted particle size distribution can be calculated using the *Multiwavelength Extinction Ratio* analysis module in SEPView software. No complex refractive index is needed and strong assumptions like spherical homogeneous particles are not necessary.

Reference: https://bit.ly/2mSotfS



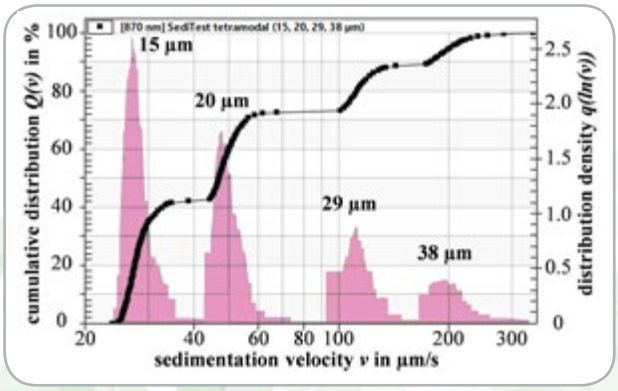


Agglomeration detected, extinction of Ludox 45 nm for different wavelengths in dependency time & ionic strength

Quality control

Quality control is the essential part for producing satisfying products. This relates to the control of the raw materials, intermediate and final products. For dispersion related products there might be changes in particle size of a single component, of the whole system or in material composition, which would affect the quality of the final product. Therefore an integral method measuring changes in size and density or rather their distribution has advantages over determining particle size distribution only. It is given with the separation velocity distribution.

Reference: https://bit.ly/2mqFeyk



Particle velocity distribution of a suspension made from batches of 4 monodisperse PMMA reference particles (nominal size indicated, LUMiReader PSA, 120 profiles, Δt = 20 s, T = 30°C, λ = 870 nm).

Magnetic properties of nano & micro particles

The LUMiReader offers you a truly one-of-a-kind feature which allows you to characterize dispersed magnetic nano & micro particles in superimposed parallel magnetic fields (in addition to the conventional gravitation field).

Reference: https://bit.ly/2kJXXEC & https://bit.ly/2ll18ms

Asphaltene stability reserve

ASTM D7827 (2017)

This rapid and sensitive standard test method (*Standard Test Method for Measuring n-Heptane Induced Phase Separation of Asphaltene from Heavy Fuel Oils as Separability Number by an Optical Device*) is for estimating the stability reserve of an oil. It covers the quantitative measurement, either in the laboratory or in the field. The stability reserve is estimated in terms of a separability number. This separability number is automatically calculated by SEPView. A low separability number indicates there is a low stability reserve in the oil.

Reference: https://bit.ly/2TqedHL

Hansen Solubility Parameters

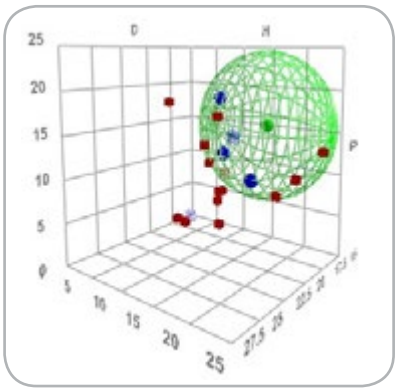
$$\delta^2 = \delta_D{}^2 + \delta_P{}^2 + \delta_H{}^2$$

Hansen formula (total energy density)

Hansen Parameters (HSPs) - in most recent publications named Hansen Dispersibility Parameters - have been widely used in diverse scientific disciplines and industries for predicting the solubility of materials in different solvents and for characterization of pigment dispersibility and wettability of various surfaces as well as of adsorption properties of pigment surfaces.

Using the 3D-Hansen space approach, particles are dispersed into a number of liquids. Based on their behavior - good or bad homogeneous distribution, extent of agglomeration or flocculation – liquids are ranked as "Good" or "Bad". The LUMiReader PSA can be applied to determine Standardized Relative Sedimentation Time (RST) as base for ranking solvents as good or bad, especially in case of fast settling.

Reference: https://bit.ly/2lmjHXA



Application: HDP of CNT

Benefits

- High-end analyser for R & D , QC and process monitoring
- Real-time analysis: every second over the full sample height
- Detect coalescence / flocculation by multi-wavelength approach
- Obtain volume & number PSD with or without refractive index
- Analyse particle properties in an overlaid magnetic field
- ISO-conform volume and number-based PSD
- Optimize sensitivity by multi-wavelength approach
- Measure stability directly and accelerated by tilting
- Get velocity distribution for fast-settling particles
- Investigate temperature effects on stability behaviour (with high accuracy in a range from 4 to 80 °C)
- Compatible with all dispersing media: water, oils, organic solvents
- Uses disposable cells
- Easy to use, easy to clean

Applications

More at bit.ly/2FwHNWl

Amino acids
Beverages
Biology
Bio technology
Ceramics
Crude oil
Dental
Filler
Fine chemicals
Food
Fuel
Inks
Minerals
Pharma
Pigments
Starch
Technical dispersions
Yeast...

i. e.

- *Colloid Particles in Ink Formulations*
- *Adjuvant Formulations comprising Tlr4 Agonists*
- *Silanization of Montmorillonite Nanoparticles*
- *Avoiding Filter Cake Cracking*
- *Synthesis and uses of organic–inorganic interfaces based on Clays*
- *Sedimentation Stability of Ampicillin Trihydrate*
- *Silanisation of Sepiolite Nanoparticles*
- *Tissue engineering with PCL/hydroxyapatite Nanocomposites*
- *Paracetamol Suspensions*
- *Beverage Cloud Emulsion Stability*
- *Hansen Parameter of Nano/Micro Particles*
- *Interfacial Properties of Cellulose Nanoparticles*
- *Adenoviral vector-based Gene Delivery in skeletal Muscle Cells*
- *Photocatalytic Activity and Colloidal Stability of TiO2 /SiO2 Nanocomposite*
- *Pickering Emulsion Polymerization of Styrene-co-butyl Acrylate Nanoparticles*
- *Oligochitosan Nanoparticles through Sol gel Methods*
- *Properties of Dental Adhesives incorporated with Boehmite Nanoparticles*
- *Sedimentation behaviour of Magnetic Nanomaterial Suspensions*
- *Surface Modification of Indium Tin Oxide Nanoparticles*
- *Emulsions containing Spirulina Biomass*
- *Settling of polymer particles*

Specifications

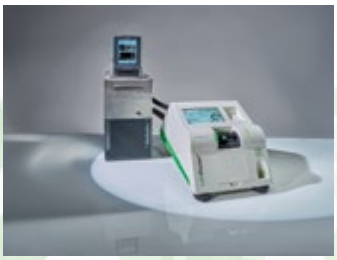
Accelerated phase separation	up to 10 times at gravity (acceleration depends on sample properties)
Particle size distribution range	< 500 nm to 300 µm
Observation time	0.5 s to unlimited
Conformity	ISO/TR 13097; ISO/TR 18811; ISO 13317; ASTM D7827; ISO 18747; CFR 21 Part 11

Sample properties

Samples	suspensions, emulsions, suspo-emulsions, sludges, slurries
Channels	1 sample
Volume	0.2 ml to 4.0 ml
Concentration	0.00015 Vol% – 75 Vol%
Particle density	up to 22 g/cm^3
Particle size	200 nm to 2000 µm

Technical specifications

Light source	multi-wavelength (NIR, red, blue)
Working temperature range*	4 °C to 80 °C (+/- 0.03 K)
Temperature stability*	0.4 K
Temperature uniformity (in sample)*	0.2 K
Ambient temperature	5 °C to 40 °C
Tilt	vertical (0°) to 5°, 10°, 15°, 20°, 25°, 30°
Cells	different materials, optical path 1 mm to 10 mm
Dimensions (WxHxD), Weight	29 x 24 x 44 cm^3 / 11 kg
Power supply	24 V, Adapter (100 V to 240 V) included
Data interface	Network adapter



*with external thermostat

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