MultiScan MS 20

Dispersion stability analysis system

Dispersion stability analysis

Dispersions are multi-phase mixtures consisting of substances that are insoluble in one another. One phase is the continuous phase in which small fragments of the other phase are dispersed. A **suspension** consists of a liquid continuous phase and dispersed solid particles. In an **emulsion** the dispersed particles are small droplets of another liquid, and a **foam** consists of a liquid continuous phase and dispersed gas bubbles.

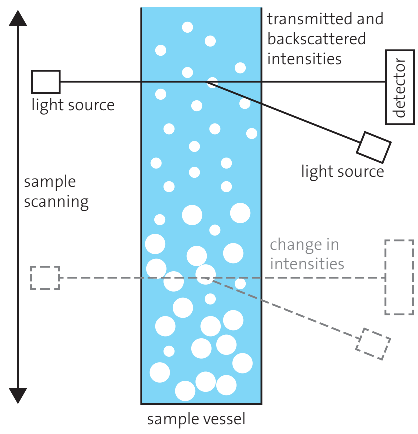
Dispersions are encountered in everyday life in many different products, ranging from **salad dressings** and **cocktails** in the food sector, **emulsions** and **creams** in cosmetic and pharmaceutical products to multi-phased **cleaning agents**, **emulsion paint** or **seal slurry** in the building industry, to name just a few examples.

For all these products the **dispersion stability** is an extremely important factor that has to be analysed and optimised during product development.

Over time destabilisation processes take place inside dispersions: the dispersed particles can **sediment** or **cream** due to gravity. Moreover phase separation occurs because of the interfacial tension: the dispersed particles **cluster** or **merge** in order to minimise their interfacial area to the surrounding continuous phase.

The **dispersion stability analysis** utilises an optical measuring procedure: with two light sources and a detector, the light **transmitted** through and **scattered back** by the sample is analysed.

The transmission and backscattering intensities directly depend on the number, size and type of dispersed particles. Hence the light intensity changes while the dispersion destabilises. For example, particles disappear from the light path due to **sedimentation** or become bigger due to **clustering**.



measuring principle of the MS 20

Stability analysis tracks these changes by scanning the sample repeatedly for a certain experiment duration. During the measurement the whole sample height is scanned, hence both **global** and **local changes** in the sample are detected.

Example: stability study of a commercial protein shake

The stability of a liquid protein shake sample was tested using the MultiScan 20 stability analysis system. By analysing the transmission and backscattering behaviour of the dispersion, unstable components were detected and various destabilisation mechanisms could be distinguished.

Protein powder is a well-known dietary supplement among athletes, which can contribute to strength and performance enhancement. Typically the powder is consumed as a protein shake where it is dispersed in water or milk.

In addition to other supplements such as vitamins and minerals, ready-made protein shakes contain stabilisers. The stabilisers are added in order to prevent the de-mixing of the product for as long as possible thus ensuring longer shelf life e.g. at room temperature.

The shakes may seem "stable" since de-mixing processes such as separation of individual components are very often invisible to the naked eye for weeks or even months. But how stable are such products in reality?

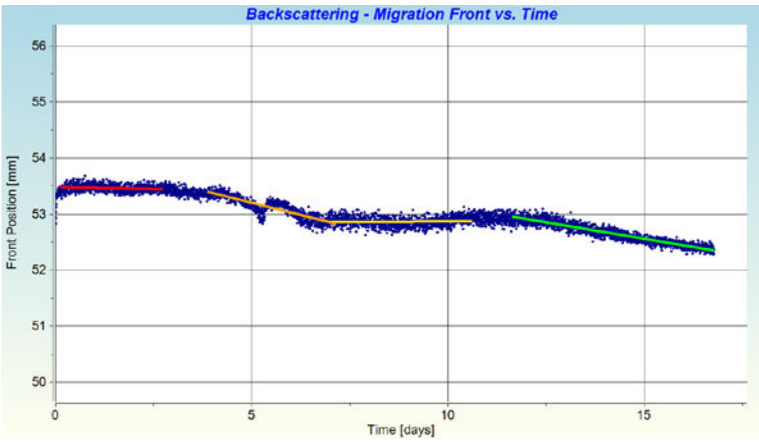
Unless they are desired, separation processes are one of the key challenges faced in product development and require thorough stability optimisations. Even the slightest changes within dispersions can be detected and evaluated by the MultiScan 20 (MS 20) and its matching software MSC. The MS 20 enables a fast and objective analysis of the dispersion stability as well as conclusions on possible destabilisation mechanisms.

Results:

The migration front shifts only very slightly during the first three days. Between day 4 and day 7 it moves towards the bottom of the vial at a speed of 0.17 mm per day and across a distance of approximately 0.5 mm. This initial migration is explained by the separation of the components and the resulting sedimentation of particles.

A stable position of the migration front can be seen from day 7 to day 12 at a height of 53.0 mm. From day 12 onwards, the migration front moves once more towards the bottom of the vial at a speed of 0.12 mm per day.

For the complete application note please refer to our website.



MultiScan MS 20

The MultiScan MS 20 is the measuring device for the automatic optical dispersion stability analysis, which is **fast**, **sensitive**, **non-destructive** and can measure samples in their **original concentration** and under **realistic storage conditions**.

Hence, a variety of multi-phase dispersions, in particular **suspensions and emulsions**, and their time- and temperature-dependent destabilisation mechanisms can be comprehensively characterised.

The base unit of the MS 20 features an **integrated touch screen** that displays status information and can be used to control important base functions. Additionally it is possible to register the studied samples, fast and conveniently, with the **built-in** or an optional handheld **barcode scanner**.

The MS 20 uses **up to six independent ScanTowers** for the measuring process. Hence, samples can be individually analysed at different temperatures and with different measuring parameters.

The temperature inside the ScanTower **ST-TEC** is controlled using an electric resistance heater and a liquid counter-cooling. This allows for measurements in a **temperature range of -10 °C to 80 °C**. Temperatures below 4 °C require an optional thermal insulation sleeve.

Due to the possibility of using several ScanTowers on one MS 20, samples can be analysed in short- and long-term experiments side by side.

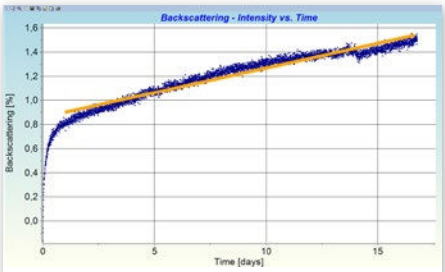
The MS 20 uses screw cap glasses with a special cap as sample containers for **easy insertion** into the measuring chambers of the ScanTowers. Using adapters sample containers of various dimensions and with **disposable glass vials** can also be used to facilitate measurements with reduced sample layer thickness or with hard to clean samples.

MS 20 with six scan towers ST-TEC

Software for an efficient workflow

The intuitive MSC control and evaluation software supports you in the use of the MS 20 by easily specifying measurement procedures and in collecting and evaluating data. The software is designed for the use under Microsoft Windows® and has the following main features:

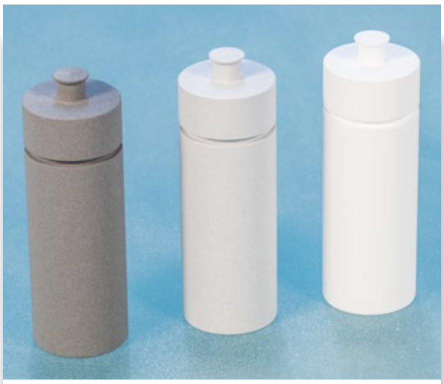
- integrated software assistant accompanying the setup of measurements and the subsequent data analysis
- measurement templates and manual set-up of measurements for scanning samples in 7 different modes
- automatic long-term and temperature-controlled measurements as well as the resumption of non-continuous measurement processes
- graphical representation of data in absolute or relative view with individual filter options
- data overlay option for fast and easy comparison of different datasets



Stability analysis using MSC software

- various data analysis options for evaluating time- and temperature-dependent variations of samples as well as determination of sedimentation and creaming rates
- evaluation of mean free path, average diameter, volume concentration, density difference, solvent viscosity, or refractive index, for spherical particles and droplets
- calculation of the initial particle/droplet size distribution in dispersions from migration profiles
- editable database with physico-chemical parameters of various solids and liquids
- determination of the Separability Number according to ASTM Standard Test Method D7061
- conversion of transmission and backscattering values to turbidity units (FNU/FTU/NTU/EBC/TUF/FAU...)
- generation of barcode labels

ScanTower ST-TEC with optional thermal insulation sleeve



Reference Body Set RBS

Technical data

Sample containers	reusable (SC xx) and disposable (SC xxD) glass sample containers in various sizes				
	SC 20	SC 20D	SC 15	SC 10	SC 10D
scanned volume	27 ml	27 ml	6 ml	2.8 ml	2.7 ml
inner diameter	25 mm	25 mm	12 mm	8 mm	7.9 mm
Sample properties					
mean size of dispersed parts	10 nm ... 1 mm				
volume concentration of dispersed parts	0.0001 ... 95 %				
Reproducibility	0.05 %				
Scanning drive					
Scan range	0 ... 56.5 mm				
Max. scan interval resolution	5 µm				
Max. scanning velocity	12.5 mm/s				
Light source and detection	Near-infrared LED				
Wavelength	870 ± 30 nm (spectral half width 45 nm)				
Detection angle	0° transmission; 45° backscattering				
Temperature control	ST-TEC with integrated electric resistance heater and liquid counter-cooling				
Temperature range[1]	-10 ... 80 °C				
Temperature measurement	Pt100 sensor for -60 ... +450 °C ± 0.01 K; precision 1/3 DIN IEC 751 (±0.03%), class B				
Device control	via integrated touch screen and software				
Max. number of simultaneous samples	6				
Sample recognition	via integrated or optional handheld barcode scanner				
Dimensions (L [mm] x W [mm] x H [mm])	295 x 260 x 165 (base unit MS 20) 130 x 98 x 275 (ScanTower ST-TEC)				
Weight	6.8 kg (base unit MS 20) 2.1 kg (ScanTower ST-TEC)				
Power supply	100 ... 240 VAC; 50 ... 60 Hz; max. 300 W				

[1] to reach temperatures below 4 °C the optional thermal insulation sleeve for the ScanTower ST-TEC is required

For more information please contact us. We will find a tailor-made solution to your surface chemistry requirements and will be pleased to provide a quotation, obligation-free, for your instrument system.

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