Thermal Analysis Excellence

Sorption Test Systems

SPS11-10µ

SPSx-1µ High Load

SPSx-1µ Advance

SPS23-100n

Multi-Sample Moisture Sorption Analysis

Simple, Accurate and Reliable

METTLER TOLEDO

Moisture Sorption Analysis
Multiple Samples with Highest Accuracy

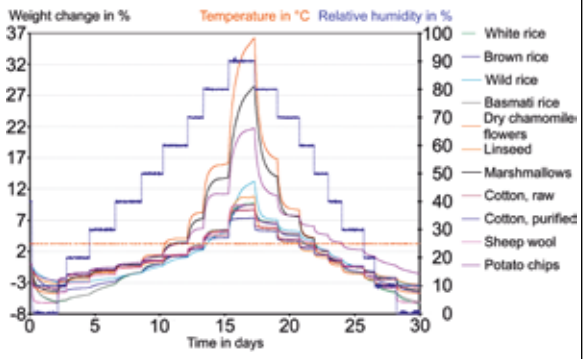
Virtually all materials interact with moisture to some extent. Understanding moisture induced changes of material properties is key to making decisions regarding processing, packaging, storage and shelf life of a product.

Features and benefits of the SPS Moisture Sorption Test Systems:

- **The only true multi sample sorpton test system** – up to 23 samples can be measured simultaneously
- **High dynamic load range** – thanks to integrated METTLER TOLEDO balance
- **Excellent baseline stability** – internal reference ensures drift compensation
- **Outstanding humidity accuracy** – polymer humidity sensor enables measurements near 0% RH
- **Optimized sorption kinetics** – due to ideal surface to volume ratio and laminar flow over the sample
- **Extra samples for additional analyses** – up to 24 samples in parallel positions for DSC, XRD, microscopy, etc.
- **Attractive options extend application range** – permeability kit, CCD video camera, and RAMAN interface available

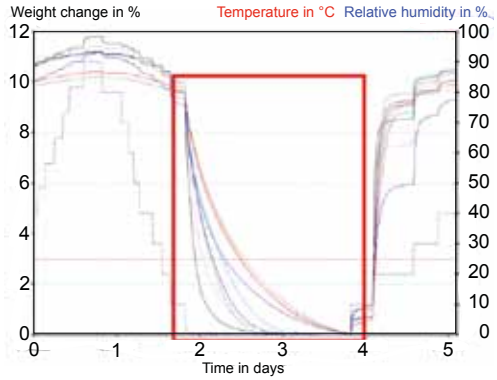
The heart of all sorption test systems is an integrated METTLER TOLEDO balance which ensures unbeatable accuracy.

True Multi Sample Sorption Tests
Allow for High Sample Throughput



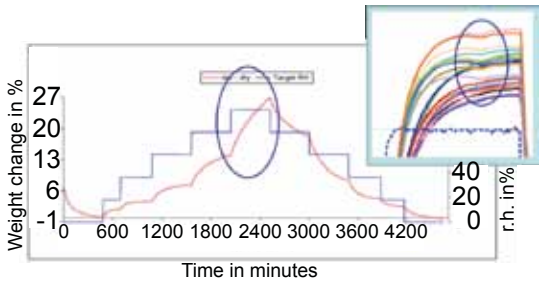
Measure more samples in shorter time

With the SPS sorption test systems, the sorption behavior of up to 23 samples can be determined simultaneously.
Especially in test series with multiple samples or high sample volumes, accumulated measurement times of single-sample sorption test systems often are far too long.
In a single sample instrument, the data to the left would have taken 11 months to generate. In the SPS, the data generation took just 30 days.



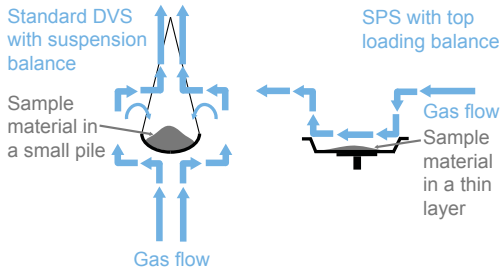
Accurate sample comparison

In the SPS sorption test systems, all samples are measured simultaneously and under the same conditions.
As the experimental conditions are identical, even the smallest differences between samples and batches can be detected.
The curves on the left show the sorption behavior of various batches of the same active pharmaceutical ingredient with different drying kinetics and hydration properties.



Access to complete sorption behavior

When using single-sample instruments, the time available for each measurement is often limited and the individual climatic settings can only be maintained for very short periods.
Important information on sample behavior, e.g. stability, may therefore be missed.
The figure shows a comparison of the same compound measured in a single-sample and a SPS instrument. The SPS measurement shows small reproducible effects missed in the other measurement because equilibrium conditions were not reached.



Optimized sorption kinetics

Proper sample arrangement and climate control create optimal conditions for sorption kinetics.
No diffusion delays, boundary layers or humidity gradients occur in the sample thanks to optimized surface-to-volume ratio and gas flow directly over the sample surface.

For All Requirements
A Suitable System

The SPS Sorption Test Systems are available in four different configurations which are adapted to different measurement needs. A broad range of options including digital imaging or RAMAN-spectroscopy can be added to the system which can contribute to an even deeper understanding of sample behavior.

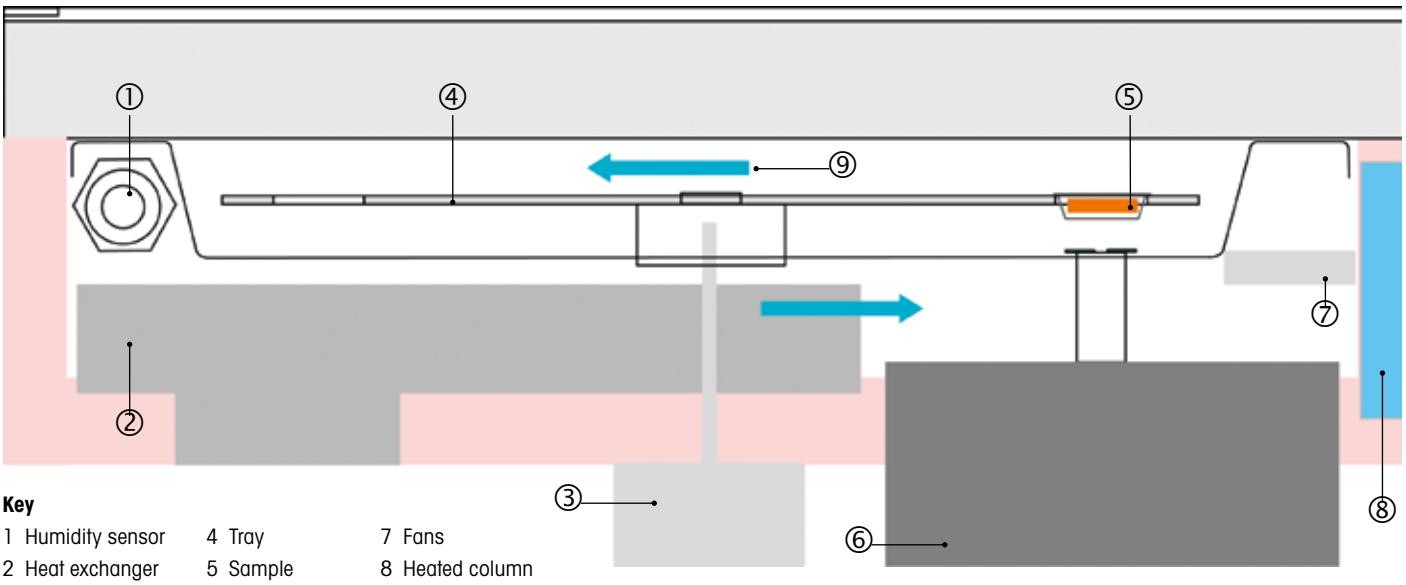
SPS11-10µ
Best suited for voluminous and bulky samples i.e. in quality control. Can be fitted with up to 11 high volume samples with a weight up to 80 g and offers a resolution of 10 µg.

SPSx-1µ High Load
The SPSx systems offer the best of both worlds: high precision or high load combined with best versatility regarding number of samples. Both can be operated with 11 or 23 samples. The High Load model offers the ability to run the largest samples thanks to a dual range balance with a resolution of 1 µg up to 22 g and a resolution of 10 µg up to 220 g.

SPSx-1µ Advance
The Advance offers better precision (±2 µg, vs ±5 µg for the High Load) with a resolution of 1 µg up to a maximum load of 22 g.

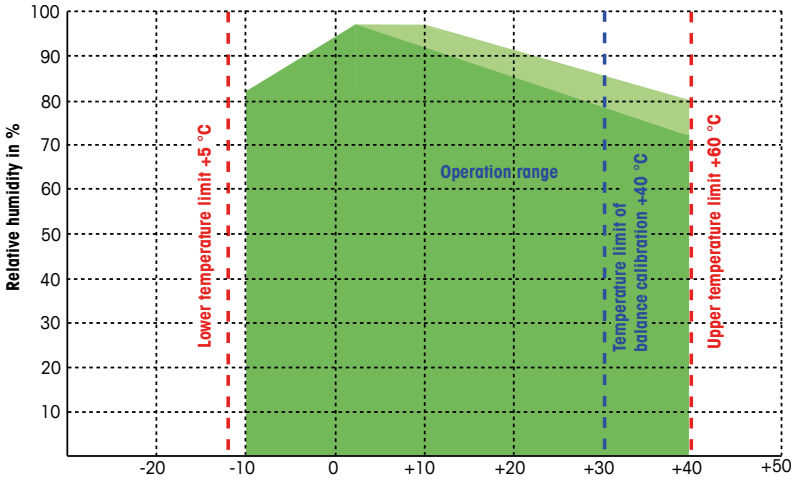
SPS23-100n
Offers high resolution for pharma applications and pre-formulation. Up to 23 samples can be measured simultaneously. Up to 2 g can be determined with a resolution of 0.1 µg.

Options
By adding special sensor mounts, SPS systems can be equipped with a CCD camera or a RAMAN PhAT probe, each with full software integration. A 21 CFR part 11 software option is available for operation in highly regulated environments. Other special options allow for multisample permeability or large objects testing.



Key

1 Humidity sensor
2 Heat exchanger
3 Autosampler
4 Tray
5 Sample
6 Balance
7 Fans
8 Heated column
9 Air flow

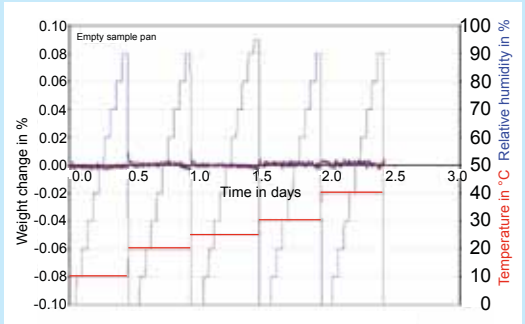


Superior measurement principle

Sample material is placed in small dishes on a rotating sample tray. Humidified air flows over the samples in a laminar fashion. The atmosphere is thermostated by a heat exchanger with large exchange area. A solid state sensor in the back accurately measures humidity and temperature. By continuously turning and lowering the tray, the dishes are placed onto the highly sensitive balance and weighed at fixed time intervals. A large range of temperature and humidity can be achieved in a measurement.

Additional samples

The SPS provides additional sample positions on the inner ring of each tray. These samples are subjected to the same humidity and temperature conditions but they are not weighed. They are therefore conditioned identically to the main sample but can be taken out any time for measurements with other analytical techniques like DSC, XRD, SEM.



Excellent baseline stability

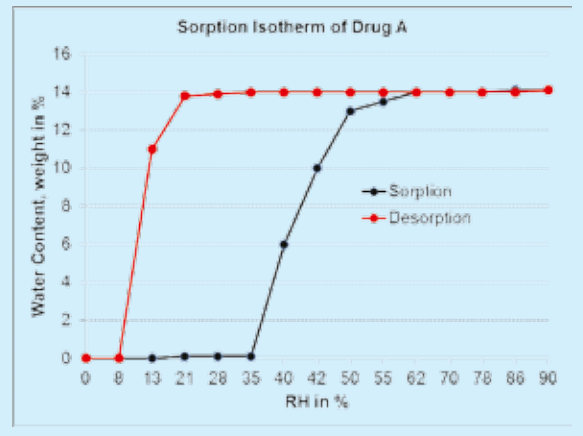
Much more reliable results can be achieved due to excellent baseline stability because of the measurement principle of discontinuous weighing and reference measurements before and after each weighing cycle. The figure shows full range stepwise humidity increase at 5 different temperatures. The weight signal as purple dots is very stable without any drift.

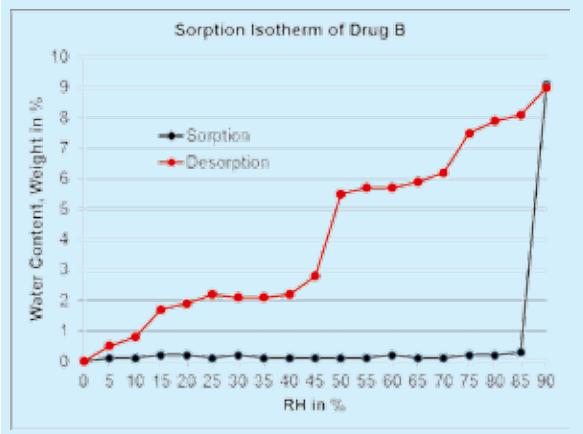
Broad Application Range

As a multitude of different materials can be investigated using the SPS systems, it is ideal both for research and development and quality control. Application areas include food, pharmaceuticals, polymers, chemical compounds, textiles, cosmetics and construction materials.

Examples of effects and materials that can be investigated with SPS systems

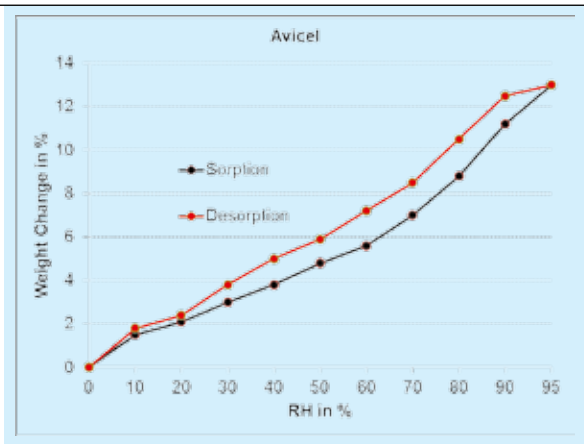
Effects	Materials
Moisture uptake and release	Food powders
Formation of hydrates	Processed food
Deliquescence	Biscuits
Amorphous content	Grains, seeds
Stability and caking	APIs
Moisture-induced glass transition	Excipients
Sorption and desorption kinetics	Tablets
Permeability and moisture diffusion	Polymers

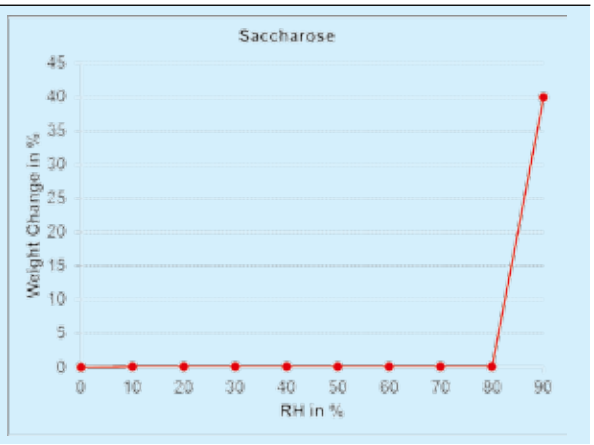


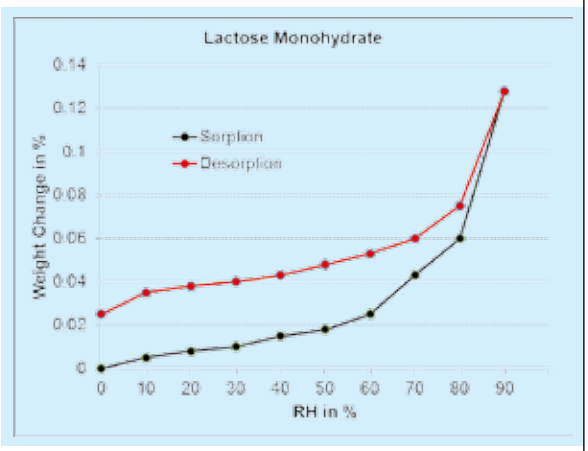


Formation of drug hydrates

The two figures show the water vapor sorption isotherms of two hydrating drugs. Drug A is a classical stoichiometric monohydrate. Drug B only changes at very high humidity of 90% r.H. into a hydrated form. Desorption runs over several well observable dehydration steps. The distinct hysteresis between sorption- and desorption curve is a characteristic for stoichiometric hydrates.

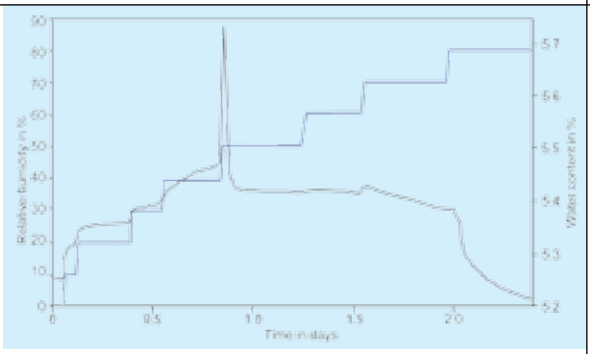






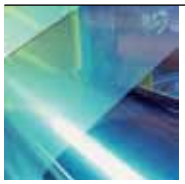
Isotherms of excipients

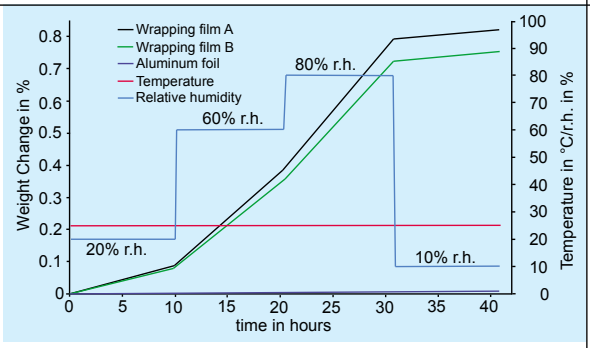
The three figures show the water vapor sorption isotherms of different excipients. Microcrystalline cellulose Avicel follows the classical sorption behavior of polysaccarides with distinct hysteresis between sorption- and desorption curve.
Saccharose exhibits liquefaction above a critical humidity of 80% r.H.
Lactose monohydrate adsorbs only 0.13% water over the entire humidity range. Nevertheless a well distinguished isotherm can be determined.



Amorphous content in spray dried lactose

With increasing relative humidity amorphous lactose adsorbs water and at certain water content the lactose becomes mobile enough to start crystallizing.
This begins at 50% r.H.. Since crystalline lactose adsorbs much less moisture, a release of excess water is observed.
Because lactose crystallizes to the monohydrate form, drying of the crystallized sample will cause a weight difference before and after the whole treatment. This weight difference is the additional water molecule that accompanies each lactose molecule in the α-lactose monohydrate crystal lattice. From this the amount of amorphous lactose that was present in the original sample can be calculated.





Permeation measurement

Using the permeation kit water vapor permeability can be measured. The experiment shows dynamic sorption curves of two different wrapping films which were measured with mole sieve located in the permeation pans. Aluminum foil which is water tight was measured as control. From the slope the diffusion in grams per square meter and day can be calculated according to EN ISO 7783-1: Part 1: "Dish method for free films". Aluminum foil adsorbs a small amount of surface water only. The diffusion through the two films is dependent on the relative humidity. Film A has slightly higher diffusion coefficient than film B.

SPS Specifications

	SPS11-10µ	SPSx-1µ High Load	SPSx-1µ Advance	SPS23-100n
No. of samples	11	11 or 23	11 or 23	23
Sample volume	12 mL	12 or 0.5 mL	12 or 0.5 mL	0.5 mL
Sample surface	20 cm^2	20 or 1.3 cm^2	20 or 1.3 cm^2	20 or 1.3 cm^2
Additional samples	12	12 or 24	12 or 24	24
Balance				
Weighing range	0.03 ... 80 g	0.03 ... 22 (220) g	0.01 ... 22 g	0.005 ... 2 g
Dynamic range	full range	full range	full range	full range
Resolution	10 µg	1 (10) µg	1 µg	0.1 µg
Repeatability	±20 µg RMS	±5 (20) µg RMS	±2 µg RMS	±1.5 µg RMS
Balance model	WXS205	WXS26	WXS206	XP2U
Temperature				
Temperature control	Peltier element			
Temperature range	5 … 60 °C	5 … 60 °C	5 … 60 °C	5 … 40 °C
Temperature accuracy	over time ±0.1 °C, uniformity ±0.5 °C			
Humidity				
Humidity control	Polymer type sensor			
Humidity range	0 ... 98% r.H.			
Humidity accuracy	±0.6% r.H. (0 ... 100% r.H.) at 23 °C ±5 °C			
Long term stability	better than 1% r.H. per year			
Dimensions W x D x H / Weight	488 x 630 x 437 mm (1024 mm with open lid) / 68 kg (without keyboard and display)			
Power supply	100–230 VAC / 50 ... 60 Hz			
Gas supply	Compressed air / nitrogen, dry and oil free			
Operating pressure	22 ... 145 psi			
Options				
	Software validation package according to 21 CFR part 11			
	Permeability testing kit			
	Camera system			
	RAMAN kit			
	Large objects tray			

www.mt.com/na-dvs

For more information

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