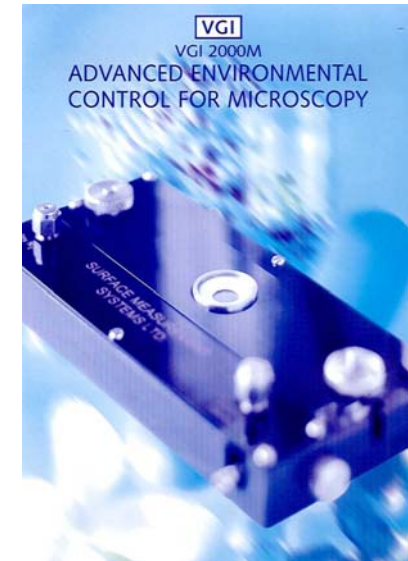


Surface Measurement Systems



SURFACE
MEASUREMENT
SYSTEMS



Euro Food's Water, Brussels, Belgium: March 2006

pattwool@smsuk.co.uk

SMS - History



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SYSTEMS

- **Company formed in 1992/university spin-off**
- **Hotbed of innovation – 10 Ph.D.'s**
- **First Product Dynamic Vapour Sorption (DVS) 1993**
- **DVS Microscope and Organic Vapour Options 1996**
- **First commercial Inverse Gas Chromatograph 2000**
- **Vapour Generator Instrument 2001**
- **DVS High Throughput 2005**

DVS Introduction



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Materials and Moisture

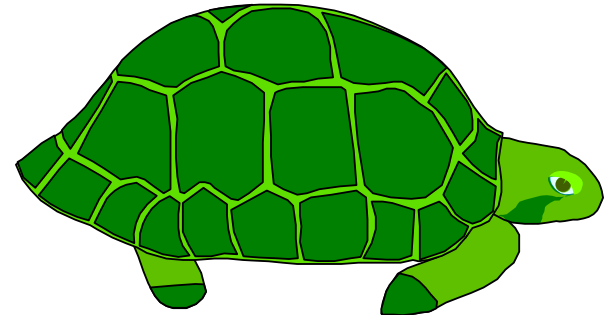
- How do materials interact with moisture in the environment ?
- Effects stability, performance and safety of many materials.
- **Isotherm** - Equilibrium moisture content as a function of **Relative Humidity**. How much is taken up.
- Kinetics – Moisture transport properties, how fast.

Limitations of Existing Techniques



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- **Saturated salt solutions:**
 - **Very slow: weeks for one isotherm using static gravimetric saturated salt solution techniques.**
 - **Labour intensive if many humidity levels required.**
 - **Not able to study kinetics of sorption/desorption.**
 - **Limited accuracy/precision.**



DVS - Flowing Gas System



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- Weigh sample continuously.
- Fully automated gravimetric instrument.
- Fast kinetics.
- Caking.
- Dynamic system - constant flow of gas ensures optimal mass transfer rate to and from sample - i.e. reaches equilibrium faster.

Dynamic Vapour Sorption



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- Experiments may be completed in **less than 24 hours**.
- Entire system enclosed in **temperature controlled environment** - prevents condensation.
- **Small sample size** (typically 1-100mg) reduces time needed to establish equilibrium.
- **Continuous monitoring** of mass allows computer to decide when equilibrium is reached.
- Full control and monitoring of sample environment.

DVS Flow - Microbalance



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Digital recording ultra-microbalances:

DVS Advantage - 1

- Sample size up to 1.5 gm
- Mass change of +/- 150 mg with 0.1 μg resolution.

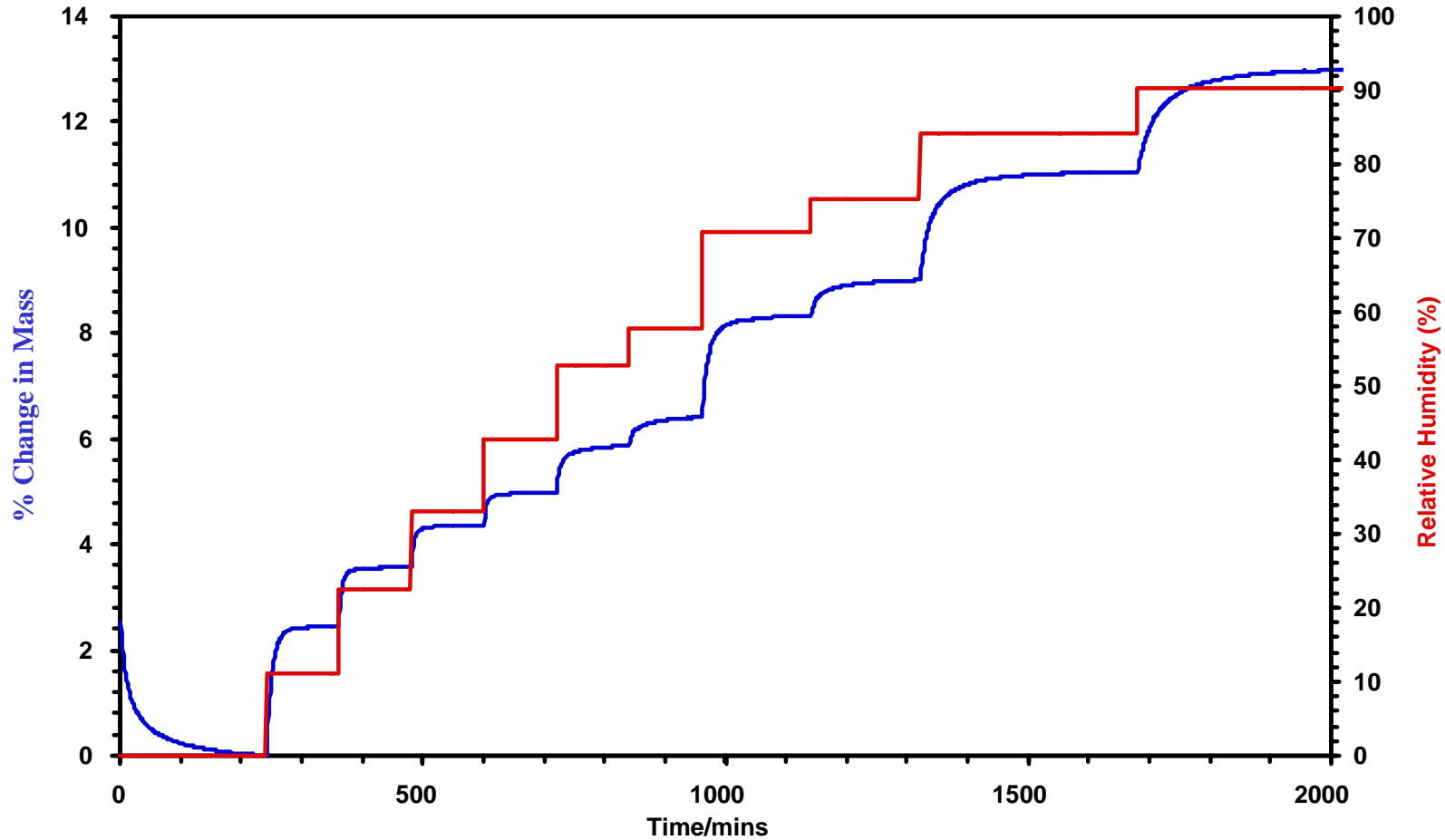
DVS Advantage - 2

- Ideal for larger food samples.

Kinetics of Moisture Sorption of Microcrystalline Cellulose



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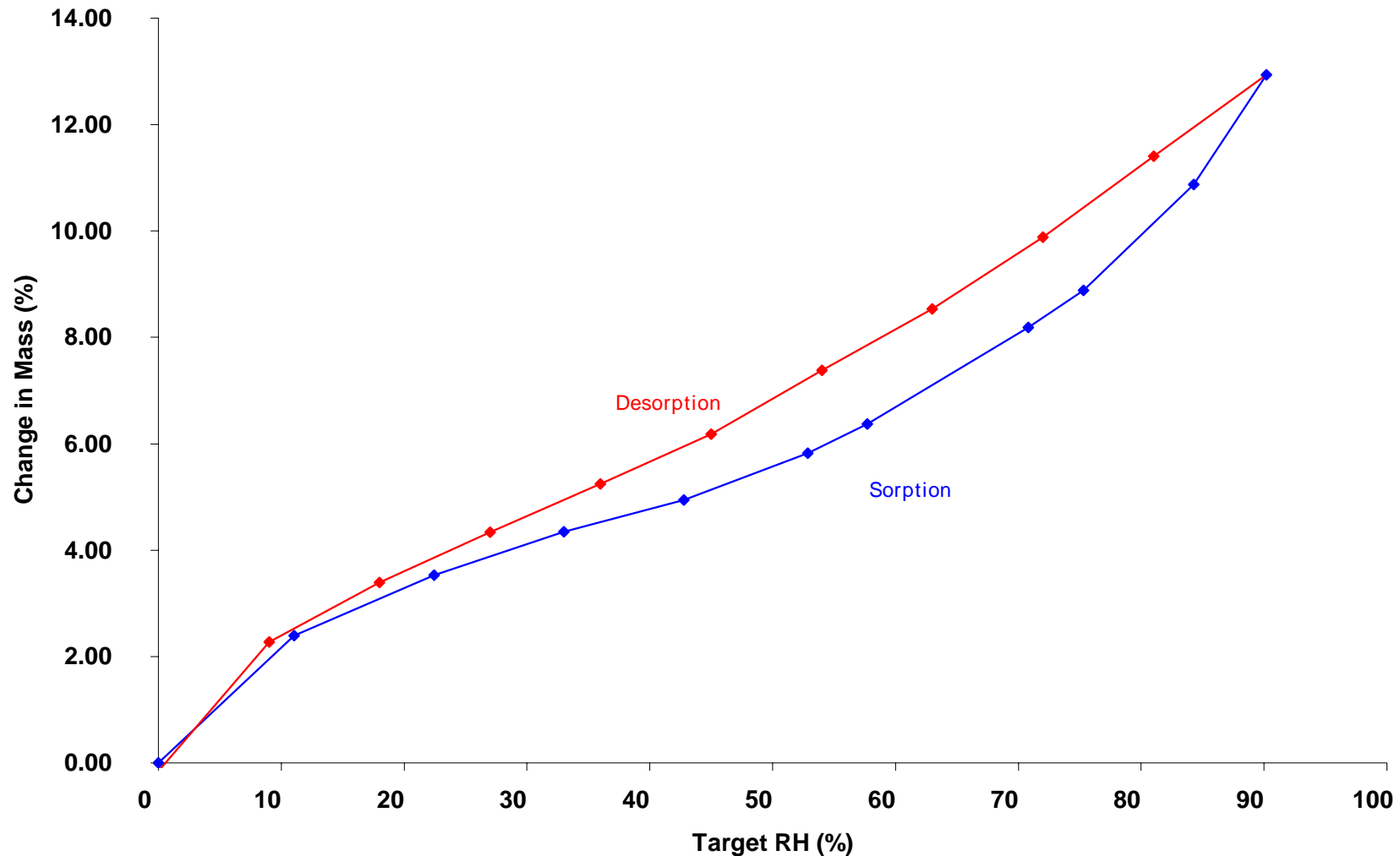


Moisture sorption behaviour of micro crystalline cellulose at 25C- Sorption only shown

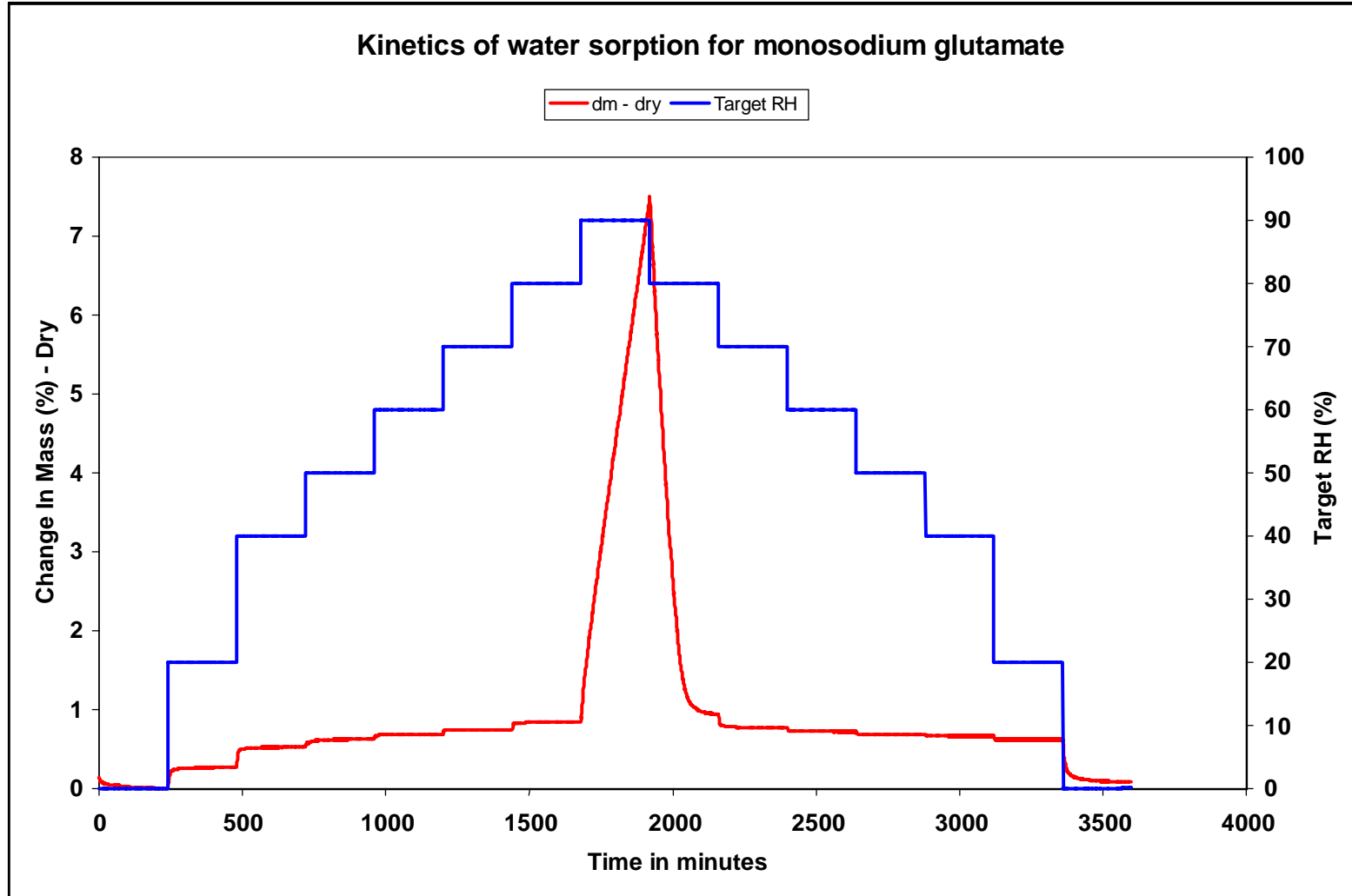
Microcrystalline Cellulose - Isotherms



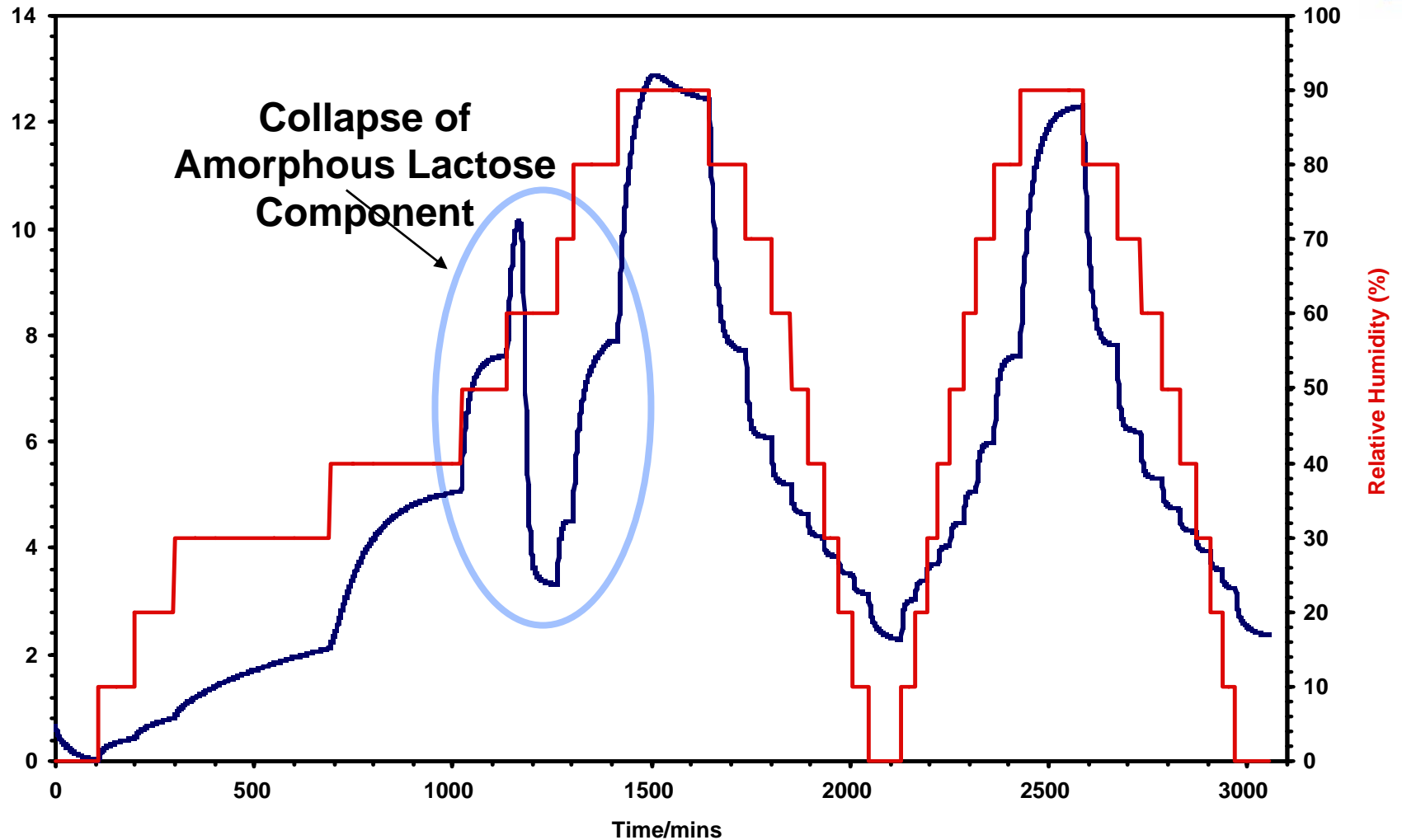
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Water Uptake Kinetics of Monosodium glutamate



Spray Dried Milk Powder - Kinetics



DVS- HT - *The Next Generation*



DVS-HT the High Throughput Solution



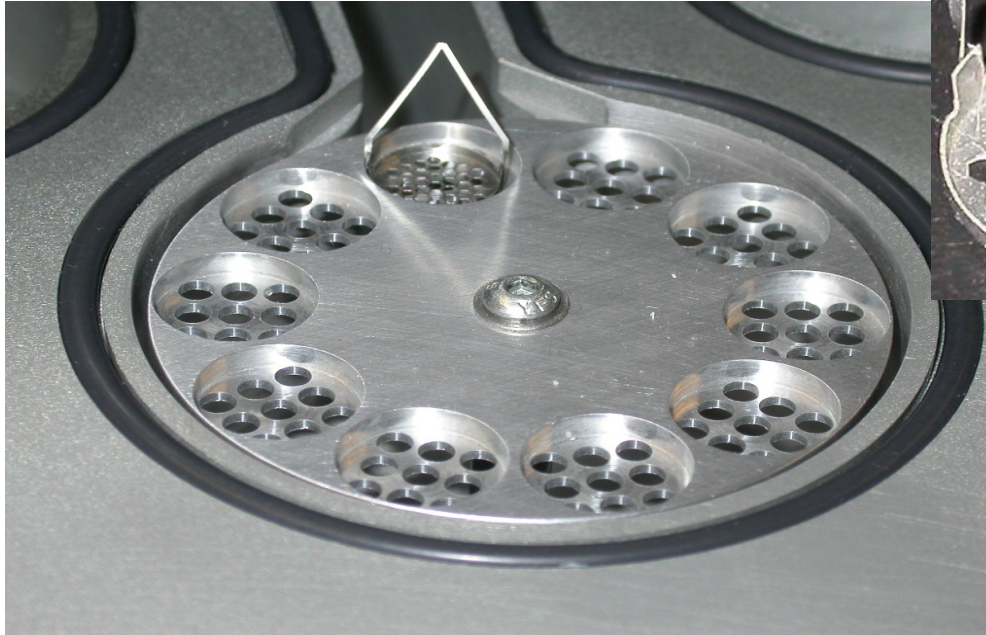
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- **All new design.**
- **Fully automated operation.**
- **Multi-sample, high speed isotherm generation.**
- **10 to 20 fold increase in efficiency over existing systems and technology.**
- **Designed for routine sorption analysis.**
- **No compromise data quality.**

Carousel and sample pan



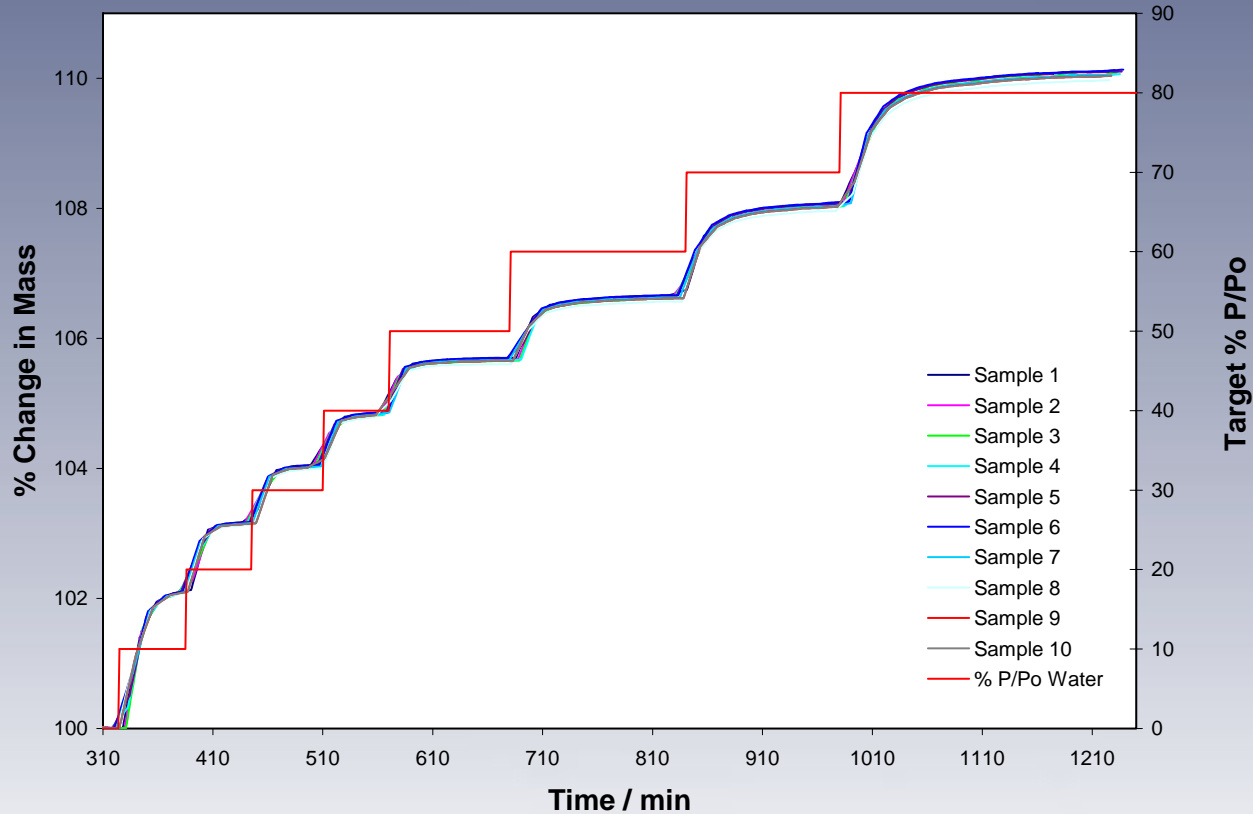
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Avicel 10 HT samples



Moisture Uptake for Avicel at 25C :
10 Sample Pans



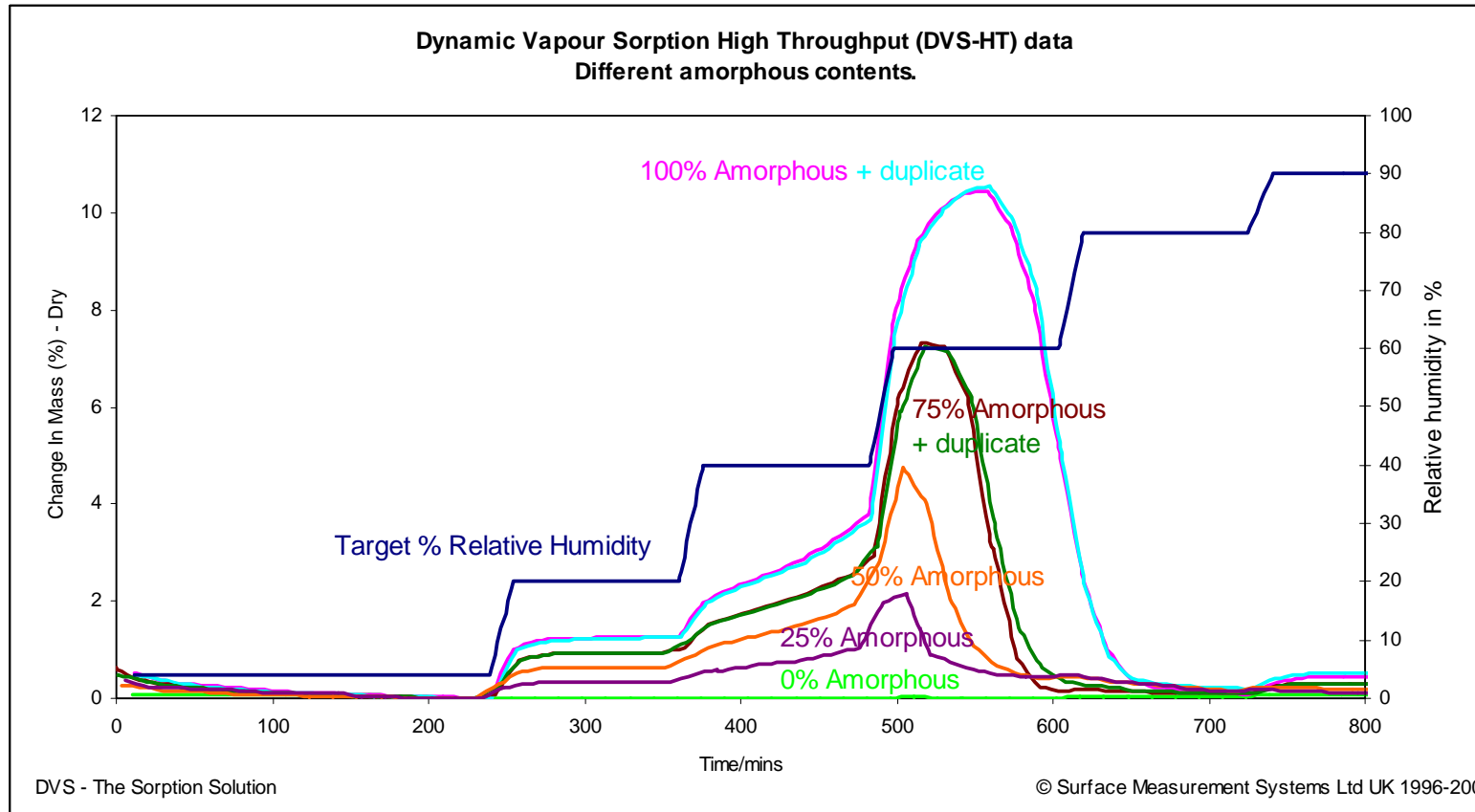
DVS-HT Dramatic lactose photos 29.1%RH versus 59.0%RH



Spray Dried Lactose/DVS-HT



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Sustained Release Capsules

90% RH t=0 hours

90% RH t=10 hours



←→
1000μm

DVS - Applications



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SYSTEMS

- **Fast and Accurate Sorption Isotherms**
- **High Throughput option now available**
- **Caking, shelf-life and hygroscopicity measurements**
- **www.smsuk.co.uk**
- **Dr. Philip Attwool**
- **pattwool@smsuk.co.uk**