

From Weight to Volume

Gravimetric solutions for pipette calibration

Isabelle Schrepfer, Mettler-Toledo AG

Regular testing is essential to ensure that pipettes work accurately and precisely. However, measuring the volume of liquids is subject to inherent risks, particularly when the volume is small. Gravimetric solutions for testing and calibrating pipettes offer precise and regulatory compliant solutions to ensure that these critical lab instruments always perform within specifications.

Widely used in biology and chemistry applications, pipettes play a key role in the laboratory. In projects, where the product development process is long and a great deal of money has been invested, it is important that the impact of the pipette's accuracy on the quality assurance process is considered.

The need for regular testing

Each pipette is unique and demonstrates its own measurement uncertainty. Testing and calibration of pipettes is essential to ensure the dispensed volume is within the specified process tolerances. Only with regular testing, can companies be sure that their pipettes remain within tolerance, and only with rigorous documentation can they be sure of fully traceable results and satisfy their auditors. Without regular testing, it may be impossible to determine if and when a pipette has gone out of tolerance, which may result in very costly reworking and a lot of wasted time.

Determining volume accurately by weighing

There is no independent standard reference volume. The liter is officially defined as a cubic decimeter and so is based on length rather than volume. The volume of a liquid is dependent on temperature and pressure which

makes it extremely difficult to define and manage a standard based directly on volume. By contrast, a weight is not affected by these influences, although weighing equipment must be calibrated to the installed environment. Testing pipettes is also complicated because the dispensed volumes may be as small as 1 µl. This is not only very difficult to measure but evaporation of the test water has a significant influence on the measured result. An indirect method of determining the volume is therefore necessary.

The traditional solution for determining volume is gravimetrically. Many regulations are in place to standardize gravimetric determination. All the tests and adjustments for a correctly managed balance can be traced back to the international prototype kilogram. Regular testing of correctly installed balances ensures compensation for environmental conditions such as temperature and atmospheric pressure. These influences do not affect the weight of the test water, but may change its volume. The measurement uncertainty of a balance can also be determined by standard procedures so a volume can be calculated with a known degree of confidence.

Pipette calibration

ISO 8655 not only describes the construction requirements for piston operated pipettes but includes testing pipettes by



Isabelle Schrepfer, born in 1986, graduated from the Swiss Federal Institute of Technology in Zurich (the ETH) with a Bachelors degree in biology. She continued her studies here and obtained a Masters in neuroscience. Schrepfer was then employed as a researcher by the Institut für Hirnforschung (brain research institute) She has been working as Product Manager LHCD (Liquid Handling Calibration Devices) for Mettler-Toledo AG since 2010. Her specialist fields are pipette calibration and software solutions.

the gravimetric method to determine the measurement uncertainty, and specifies the balance resolution required for specific volumes. The test water from the pipette is dispensed directly into the receptacle on the balance. The volume of the liquid is calculated by applying a correction factor to the weight which is directly related to the density of the test water and allows compensation for temperature and atmospheric pressure. Typically, a series of ten measurements are taken to provide an average. The standard deviation, or spread, of the results is a measure of the repeatability or uncertainty of the pipette.

Calibrating micropipettes

To determine volumes as small as 1 µl gravimetrically, the ISO standard specifies that a microbalance is necessary in order to meet the required tolerance specifications. METTLER TOLEDO's XP26PC is a microbalance specifically designed for the calibration of micropipettes and is suitable for determining the weight of such small volumes. The integrated evaporation trap minimizes evaporation from the dispensed test water to ensure a more accurate result and decrease stabilization time. The cover to the evaporation trap opens automatically when the pipette breaks the integrated light beam. This creates an ergonomic handling process and minimizes operator fatigue during this highly repetitive process.

Converting the weight to volume

Due to the number of pipette tests which must be carried out, the complex conversion process is best performed with a dedicated solution. METTLER TOLEDO's Calibry Pipette Calibration software supports the entire calibration process with full user guidance and comprehensive pipette management functionalities. Calibry ensures compliance with ISO 8655 and not only automatically converts the weight into a volume but also translates weight uncertainty into volume uncertainty. By saving all calibration data in a secure database, Calibry also assists users to fulfill FDA 21 CFR Part 11. The full calibration history of individual pipettes is easily accessed and can be printed in a report at any time.

The latest release of the Calibry software is now also compatible with RFID-enabled pipettes, such as Rainin's Pipet-Lite XLS series. Calibry can read and write information on the RFID tags such as the pipette's serial number, its assigned project and recalibration date. This presents a major advance in the monitoring of pipette calibration dates and provides companies with an increased level of security in their day-to-day processes.

■ isabelle.schrepfer@mt.com

Efficient solutions for the calibration laboratory

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Pipettes play a central role in the laboratory and have to satisfy complex requirements. For the calibration of micropipettes the ISO-Standard requires the use of a microbalance (in the picture: The XP26PC from METTLER TOLEDO).

Important step achieved in Alzheimer research

A working group led by Prof. Steffen Rossner, Paul Flechsig Institute for Brain Research at the University of Leipzig, together with experts from the Halle biotechnology company Probiodrug led by Prof. Hans-Ulrich Demuth, has explained a mechanism, by which abnormal protein deposits reach the hippocampus of Alzheimer's patients. The hippocampus is the part of the brain responsible for learning and memory.

Using real-time observations of the transport processes, the researchers were able to detect that malignant amyloid reaches the hippocampus via nerve fibres. They also found that the enzyme glutamyl cyclase is responsible for various forms of this deposit. The aim now is to inhibit the enzyme by the administration of targeted active agents. The development and testing of these agents is already under way at the collaboration partner in

Halle. With this therapy approach, validated by current research, the development of a particularly aggressive form of the amyloid peptides could be prevented without compromising the function of the "normal" amyloid peptides that are important for the healthy body.

Source: University of Leipzig
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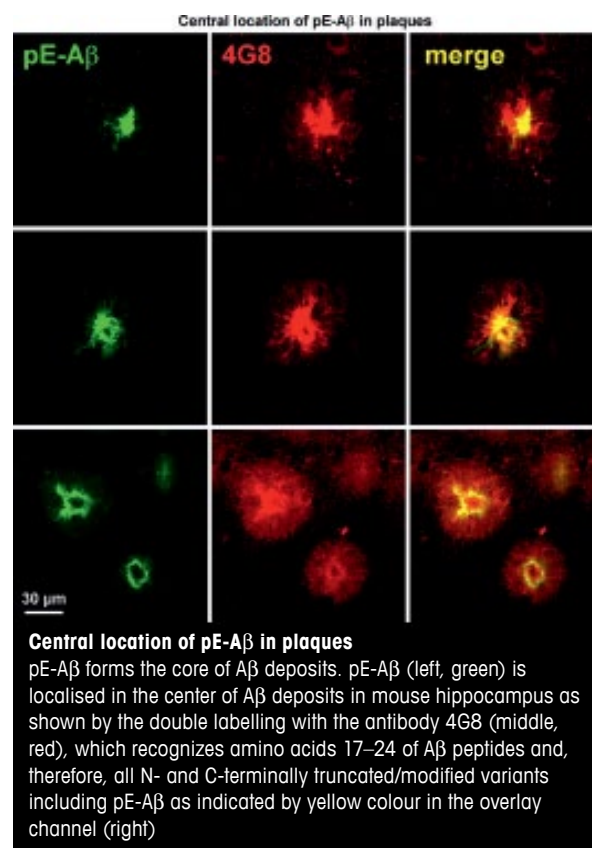


Photo: University of Leipzig / S. Rossner

Artificial skin thanks to spider silk

Spider silk could be the key to the successful culturing of artificial skin, and thus help to heal chronic wounds and burns. This, Hanna Wendt has found in her doctoral work at the Medical School Hannover (MHH).

For the culturing of skin cells, the researcher from the Department of Plastic Hand and Reconstructive Surgery used the thread of the golden orb weaver, which is a native of Tanzania and cannot control this thread production. The silk thread can be wound onto a one square centimetre stainless steel frame by gently pulling, in doing so creating an area of fine mesh. After 10 to 15 minutes of milking per spider, a thread of up to 400 metres in length can be obtained. Skin cells, which Wendt applied to this mesh and supplied with nutrients, warmth and air, grew two overlapping tissue-like skin layers: keratinocytes formed an epidermis, fibroblasts the underlying dermis. Now animal experiments must show how well this replacement grafts.

Source: MHH
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Photo: MHH/Kaiser

Hanna Wendt with the small frame onto which she has wound the silk of the golden orb weaver.