

How to Check/Calibrate Your Hygrometer?

Oulfa Belhadj, Véronique Rouchon

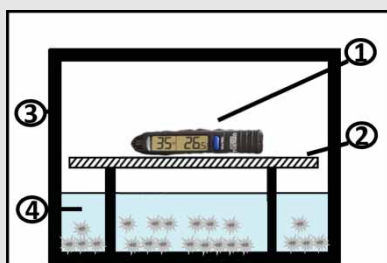
Introduction

Hygrometers available on the market are initially calibrated, but this setting may evolve with time, meaning that the displayed values are not always reliable. The most sophisticated hygrometers can be recalibrated, but the cheapest ones usually do not include this option. For calibrating or checking your hygrometer, it would seem necessary to make small enclosures, inspired from a standard (ISO 483:2005) and the literature (Greenspan 1977). It is based on the fact that the relative humidity (RH) above a salted solution is regulated by the nature of the salt and its concentration. Hence the easiest way to achieve a reproducible concentration is to consider saturated solutions. If the water evaporates, the salt will precipitate yet its concentration in solution will remain the same. Moreover, for some specific salts, the RH above the saturated solution is practically

independent from the temperature. Table 1 lists some of the most suitable salts. It is advisable to calibrate/check your hygrometer over a range of RH that is comparable to the application (for instance, a hygrometer could work perfectly between 40 and 60% RH while displaying biased values over 80% RH). The difference between the displayed value and the physical RH value of the enclosure should remain below the accuracy stated by the supplier. If not, the hygrometer should be re-calibrated.

Materials

- Hermetic box
- Salt and water (tap water or demineralized)
- Spatula
- Hygrometer
- Non-hermetic support



1. Diagram of the calibration set-up: hygrometer (1); non-hermetic support (2); hermetic box (3); and saturated salt solution (4).



2. Pour the water until it reaches at least one-third of the box height.



3. Add the selected salt until saturation, i.e. until the salt does not seem to dissolve anymore.



4. Let at rest overnight. If there are still some crystals remaining, the solution is saturated. If not, add some more salt.



5. Build a non-hermetic support just above the surface of the solution. Place the hygrometer on this support.



6. Close the box hermetically and wait for at least 4 hours. Check the value displayed by the hygrometer.

Table 1. Equilibrium relative humidity of selected saturated salt solutions

Salts	Chemical formula	Relative humidity at a given temperature
Potassium carbonate dihydrate	$K_2CO_3 \cdot 2H_2O$	44% (20 °C) to 43% (25 °C)
Magnesium nitrate hexahydrate	$Mg(NO_3)_2 \cdot 6H_2O$	54% (20 °C) to 53% (25 °C)
Ammonium nitrate	$NH_4 NO_3$	65% (20 °C) to 62% (25 °C)
Sodium chloride	NaCl	75% RH (20–25 °C)
Ammonium sulphate	$(NH_4)_2 SO_4$	81% (20 °C) to 80% (25 °C)
Potassium nitrate	KNO_3	94% (20 °C) to 93% (25 °C)
Potassium sulphate	K_2SO_4	97% (20–25 °C)

References

- ISO 483:2005. 2005. *Plastics – small enclosures for conditioning and testing using aqueous solutions to maintain the humidity at a constant value*. International Standard Organisation, Geneva, Switzerland.
- Greenspan L. 1977. Humidity fixed-points of binary saturated aqueous-solutions. *Journal of Research of the National Bureau of Standards Section A-Physics and Chemistry*, 81(1), pp. 89–96.

Suppliers

Sigma-Aldrich Chimie S.a.r.l, L'Isle d'Abeau Chesnes, 38297 Saint-Quentin Fallavier, France,

Tel 0 800 21 14 08, Fax 0 800 03 10 52,
www.sigmaaldrich.com (chemical salts).

Authors

Oulfa Belhadj and Véronique Rouchon
CRC, 36 rue Geoffroy saint Hilaire, 75005 Paris,
France, Tel +33 1 40 79 53 00,
belhadj@mnhn.fr
rouchon@mnhn.fr

Corresponding author: Véronique Rouchon

If you have a clever, pragmatic idea that you want to share with our readers, please contact Bas van Velzen (elandbas@mac.com).