Webinar Q&A Report:

How to Calibrate pH

Questions in this Q&A Report were submitted during the live webinar, How to Calibrate pH.

Answers have been provided by Urs Hartfelder, PhD, Product Manager at METTLER TOLEDO.

1. **What are the pros and cons of low maintenance electrodes that do not need electrolyte refilling?**

   U. Hartfelder: The main advantage is that you are sure that your sensor is always ready to use. You do not have to worry about the electrolyte level. On the other hand, once the electrolyte is used up, you will need to replace the electrode, so overall lifetime may be shorter than for a refillable electrode. In any case, it is also important to look at other properties of the sensor like junction type, membrane glass and shaft material to ensure the best performance in your application.

2. **Rather than aqueous solution, can we measure pH of organic solution?**

   U. Hartfelder: Measuring pH in organic solvents is challenging. When organic solvents are present in appreciable quantities, there is a shift in pH readings due to the effects of non-aqueous solvents on the activity of hydrogen ions and on the pH electrode. This can ultimately lead to variable readings and longer response times, obtaining inaccurate and irreproducible results.

   Moreover, conventional pH sensors are not designed for such applications. For instance, the aqueous electrolyte of conventional pH electrodes, like KCl solution, may not be miscible or may not dissolve into the sample being tested. In such cases, fluctuations in the readings may occur. In addition, crystallization of KCl may take place, clogging the junction and preventing the outflow of electrolyte, and therefore causing unstable readings. Therefore choosing the right sensor is essential in obtaining accurate results. For more information on this topic, please check out our White Paper at www.mt.com/pHLab_OrganicSolvents

3. Can you use buffer 4 and 7 if you want to measure pH 10.5?

U. Hartfelder: The buffers used for calibration must be selected according to the sample's pH. In your example, with an expected pH of 10.5, the calibration must include buffers of pH 9.21 and 11 (or similar). Use a minimum of two fresh buffers for calibration. Depending on your requirements, buffers with different levels of accuracy are available.

4. What is the recommended slope value for a good calibration?

U. Hartfelder: The slope of your calibration curve should be –59.2 mV/pH units at 25 °C. However, the actual response is often quoted as a percentage, and a good calibration should lie between 95% and 102% of the theoretical value in mV. Another measure of a good calibration is the offset at the zero point (0 mV at pH 7), which should remain relatively stable and should not exceed ±30 mV.

5. Once decanted from the stock bottle, how long can calibration buffers be used? If they cannot be used more than once, why not?

U. Hartfelder: Always use fresh buffers for calibration (check the expiry date of the calibration buffers before use). Never calibrate the sensor directly in the bottle. Do not re-use calibration buffers and never pour it back. Contamination must be avoided to ensure accurate results. Close the bottles immediately after use and store them at room temperature.

6. What is the difference in "measurement criteria" between Fast, Medium, or Strict endpoint criteria?

U. Hartfelder: It's all about speed versus accuracy. Fast offers quick results at lower accuracy. It's not recommended to use this setting for calibration. Medium is the default and is a good choice for normal measurement and calibration. Use strict if you want very high accuracy but don't mind waiting a little longer for each measurement. It's important to bear in mind that if you have an unstable sample - one that is, perhaps still reacting, or is changing temperature – using the strict setting may result in never obtaining a reading at all, in which case it's best to use the medium setting, or fast for very unstable samples.

7. Do we need to stir the sample during the measurement? Fast or slow stirring? And why?

U. Hartfelder: When measuring pH, gently stir the sample to ensure that it is homogeneous. Too strong stirring should be avoided to prevent bubble formation. It is important that calibration and measurement are done under the same conditions. Do not use the electrode to stir.

8. **During the measurement, if some water sample get into the inside of the probe through the refilling hole, does that affect the accuracy of the measured results?**

   U. Hartfelder: First of all, this should not happen under normal operation. The level of the reference electrolyte must be higher than the surface of the measured liquid to ensure steady outflow of electrolyte, and of course the refilling hole will always be higher than the level of the reference electrolyte. Depending on the contaminant and amount, this could have a significant impact on your result. In case this happens, it is recommended to check with a reference buffer to ensure that your electrode is still measuring correctly. If it does not, replace the reference electrolyte and calibrate again.

9. **Is it advisable to calibrate the pH meter before every measurement if the meter is used practically every week?**

   U. Hartfelder: A general rule is that the more frequently you perform a calibration the higher the accuracy of your results, so the frequency should be adjusted to match the requirements of your application. Some applications might require a calibration before every measurement, but in general it is enough to calibrate every 24 to 48 hours.

10. **If the requirement of accuracy level is within 0.1, what buffer should I use or what kind of calibration should I use?**

    U. Hartfelder: The accuracy of your measurement is influenced by different factors such as the accuracy of the buffers used for calibration, whether or not temperature compensation is used, if the right electrode is used for the particular sample measured, if the electrode has been given enough time to equilibrate and if the correct endpoint/measurement point is used in the meter, to mention just a few. When great care is taken with the measurements an accuracy of ± 0.05 pH units should be achievable. For an accuracy level of 0.1, high quality technical buffers are in many cases sufficient. You could also consider using buffers prepared according to DIN NIST 19266, which are specified to three digits and provide the lowest uncertainty. For additional questions about how to obtain accurate measurements, get in touch with our support team at www.mt.com/phlabsupport

Contact Information

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