EnviroAqua
CONSULTANTS INC.

Water Talk

Maintaining Accurate pH Readings

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Introduction

In the process world, pH is an important parameter to be measured and controlled.

The pH of a solution indicates how acidic or basic (alkaline) it is. The pH term translates the values of the hydrogen ion (H^+) concentration - which ordinarily ranges between about 1 (10^0) and 0.000000000000001 (10^{-14}) gram-equivalents per liter - into numbers between 0 and 14.

On the pH scale a very acidic solution has a low pH value such as 0, 1, or 2 (which corresponds to a large concentration of hydrogen ions; while a very basic solution has a high pH value, such as 12, 13, or 14 (which corresponds to a small number of hydrogen ions). A neutral solution pH of 7.

Knowing the basics of how a pH sensor works can help in when troubleshooting in the field.

Inorder to measure pH, two sets of electrodes are used, a reference electrode and a measuring electrode. These can be separate, or housed together in the same probe.

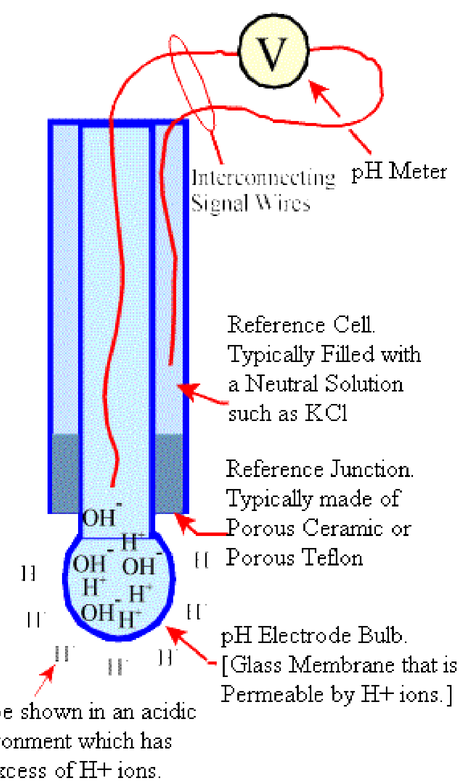
The pH of the solution inside the reference electrode does not change, nor does the strength of the electrical charge that reference solution generates. When the sensor is immersed in a test sample, an electrical charge is created on the outside of the measuring electrode. This electrical charge is proportional to the solution pH. The meter then determines the difference in electrical charge between the reference electrode and the measuring electrode. This difference is reported as the solution pH.

From the above discussion it is obvious that the sensor must be free of any deposition so that it is f free to determine the difference in electrical charge generated between the sample and the reference fluid.

Knowing when to clean and calibrate the sensor is the key…

Cleaning & Calibration Scheduling

Many plants must carefully monitor pH readings. Accurate readings require a clean and properly calibrated pH sensor. The question then becomes, how do you determine when it is time to remove and clean or calibrate a sensor? Or, should the sensor undergo a cleaning, or a calibration, or both?



What to do can be confusing. Some processor operational guidelines do not adequately detail the timing or procedures for pH sensor maintenance and calibration, while others call for many more actions than situations dictate. Whenever possible, users should develop their own maintenance and calibration schedule.

A Straight Forward Approach

First, take a newly installed pH sensor out of the process after a set amount of time. This could be a day or two. Perform a visual inspection of the sensor. If the sensor appears to be free of debris/fouling, then rinse the sensor in distilled water and then perform a buffer check. This can be performed using the calibration buffers you typically use. If the sensor reads within the tolerance defined in your operational procedures in the offset (7 pH) and span (4 pH) buffers, it needs no further action and can be reinstalled.

Contaminant	Cleaning Solution
Alkaline or scale	5% HCl or vinegar
Acidic coatings	Weak caustic (less than 4%)
Oil, grease, organics	Detergent, or if coating is tenacious, an organic solvent compatible with sensor material

Repeat this step every couple of days until you see a change in either the level of debris/foulant on the electrode and reference surfaces, or you get readings that exceed the tolerance. This identifies the time interval at which you must perform maintenance.

Now, you must determine whether the sensor just needs a cleaning or a cleaning and calibration. First clean the sensor (see below).

After the cleaning, retake the readings. If these fall outside your pass/fail criteria, a cleaning solution alone will not suffice. You will have to calibrate the sensor.

Sensor Cleaning Techniques

When the electrodes do require cleaning, remove the bulk of the contaminant by carefully blotting or wiping away the debris. Do not rub too vigorously as this may cause a static charge. Rinse the sensor in warm tap or distilled water.

A water jet from a faucet or spray bottle might remove a slight coating or scaling. For more entrenched coatings, immerse the sensor for up to five minutes in a hot water solution containing a dishwashing detergent (like DAWN) that does not contain abrasives or lanolin. Lightly scrub the electrode for a few seconds with a soft bristle brush.

If the detergent solution cannot remove the coating, then dip the brush in a 2% HCl solution and lightly scrub the electrode for a few seconds, or soak the electrode in the solution to really work at attacking the contaminant.

If that does not do the trick, then you may need to resort to a higher concentration of acid, or an alkali or solvent, depending upon the nature of the deposit.

Right after cleaning, rinse the sensor in water and place it in tap water or a 7 pH buffer solution until the sensor stabilizes. Then retake the readings. If the senor responds accurately, then reinstall it. If not, It Is time for replacement sensor.

A more rugged field pH measurement approach

Hach has a line of new Field meters which are more robust. Their new approach eliminates the issues with glass bulbs that can dry out. The bulb is replaced with a silicone chip, non-glass pH sensor. This new sensor will store, dry, with minimal maintenance, and is virtually indestructible.

The *H Series H138 Elite minilab ISFET pH Meter* comes complete with a storage case as well as three pH buffer solutions for field calibration.