How to Store, Clean, and Recondition pH Electrodes

1. **Introduction**

   Taking care of your pH electrodes will ensure proper functioning, as well as enhance their longevity. Read the following primer on the best methods for storing, cleaning, and reconditioning electrodes:

2. **Storing Electrodes**

   For best results, always keep the pH bulb wet, preferably in a storage solution or in pH 4.01 buffer with 1/100 part of saturated potassium chloride (KCl) added. Other pH buffers or tap water are acceptable storage media, but avoid storing in distilled water because it will deplete the hydration layer of refillable electrodes, and decrease the life of nonrefillable electrodes. The electrolyte level in the outer cavity should be kept above the level of the solution measured. An electrode storage bottle can be used for short- or long-term storage.

   To reuse the storage bottle included with the electrode, slide the cap and then the O-ring onto the electrode, insert the electrode midway into the bottle containing storage solution (or a 50:50 mixture of 4 M potassium chloride and pH 4 standard buffer), and gently screw on cap. Close the fill hole on liquid-filled units. (Insertion directly into the cap/bottle assembly with the cap/O-ring in place may cause harm to the electrode by damaging the junction or it may develop pressure and cause storage liquid to flow into the electrode.)

   KCl and pH 4 buffer provide good conditions for mold to grow. To prevent mold from growing in storage solutions, use up to 4% of sodium benzoate or azide in the reference fill and storage solutions.

   If the electrode has not been hydrated (i.e. placed in solution for more than one hour), allow the electrode to soak in a buffer (preferably pH 4) prior to

standardization or measurement. This will help optimize and re-establish the thin hydration layer on the sensing bulb, which is critical to pH measurement.

NOTE: Electrodes should not be stored for a period longer than six months. Electrode stock should be rotated accordingly.

3. Cleaning Electrodes

   Mechanically intact electrodes with no broken parts can often be restored to normal performance by one of the following procedures:

- General Cleaning: Soak the electrode in 1:10 dilution of household laundry bleach in a 0.1 to 0.5% liquid detergent solution in hot water with vigorous stirring for 15 minutes. Place junction under warm, running tap water for 15 seconds. Drain/refill the reference chamber. Soak the electrode in storage solution for at least 10 minutes.
- Salt Deposits: Dissolve the deposit by immersing the electrode in 0.1 M HCl for five minutes, followed by immersion in 0.1 M NaOH for five minutes, and thorough rinsing with distilled water.
- Oil/Grease Films: Wash electrode pH bulb in mild detergent or methanol. Rinse electrode tip with distilled water.
- Clogged Reference Junction: Heat a diluted KCl solution to 60 to 80oC. Place the reference portion of the pH electrode into the heated KCl solution for approximately 10 minutes. Allow the electrode to cool while immersed in unheated KCl solution.
- Protein Deposits: Dissolve the deposit by immersing the electrode in a 1% pepsin solution with a background of 0.1 M HCl for five minutes, followed by thorough rinsing with distilled water.
- Air Bubbles: If air bubbles appear in the electrode (especially with microelectrode and narrow test tube electrodes), open up the fill hole, grab the cable of the probe about 18" from the connection to the electrode, and spin in a circular motion over your head (like a helicopter) for about a minute. The centrifugal force should force the air bubble to the fill hole/top of the electrode.

After any of these special cleaning procedures, remember to drain/refill the reference chamber, if refillable. Soak the electrode in storage solution for at least 10 minutes prior to use. If these steps fail to restore normal electrode response, replace the electrode.

1. **Reconditioning Electrodes**

   Older electrodes, or electrodes that have been stored dry, may need to be "reconditioned". Recondition an electrode by soaking it in pH 4.01 buffer or electrode storage solution for at least 30 minutes.

   Here are other tips for reconditioning or reviving an electrode:

   Often electrodes are used in applications that require regular cleaning of the electrode or reference. These applications usually involve very hard waters (with high scale content), dirty samples like soil slurries, viscous materials, or samples with high oil and protein content.

   As with any procedure involving strong chemicals, please wear appropriate safety apparel and goggles, and provide adequate ventilation. *These procedures are not recommended for persons unfamiliar with, or unable to use, safe techniques involving these chemicals: detergents, HCl (hydrochloric acid), NaOH (sodium hydroxide).*

   Method 1: Soak the electrode in a 0.4 M of HCl (hydrochloric acid) for 10 minutes, then rinse the electrode with deionized or distilled water. This should remove any organic protein from the glass electrode and the surface of the reference electrode.

   Method 2: Soak the electrode in a 3.8 or 4.0 M KCl (potassium chloride) solution heated to 50oC for one hour. Allow the KCl solution to cool down to room temperature, then rinse the electrode with deionized or distilled water. This will open and clean the reference electrode of all contaminants.

Method 3: Soak the electrode in a 4.01 pH buffer solution, heated to 50oC for one hour. Allow the buffer to cool down to room temperature, then rinse the electrode with deionized or distilled water. This will open and clean the reference electrode.

Method 4: After each use, rinse the electrode in 0.5 N or 1% HCl. If you have a buildup of oil or protein contaminants, try soaking the electrode in a warm detergent and water solution. Degreasing dishwashing detergents or stain-removing prewash pretreatments are ideal for this (any brand will work). An overnight soak may be needed if buildup is heavy. Then rinse the electrode in deionized or distilled water and soak for 10 minutes in 1% HCl. Rinse the electrode again in deionized or distilled water and then calibrate using pH buffers. If the electrode calibrates to buffers, it can be used in tests. When the electrode cannot be calibrated, even after attempts to clean it, it must be replaced.

Method 5: For protein removal, soak the electrode in a contact lens enzymatic cleaner solution overnight. The enzymes will remove proteins from glass and plastic.

Look for Part 2 in this series, Troubleshooting pH Electrodes, in the next edition of eNews