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Water Analysis Equipment©

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BENEFITS AND APPLICATIONS OF PH, CONDUCTIVITY, AND SALINITY MEASUREMENT

Importance of pH. The pH is a measure of a liquid's acidity and alkalinity.

- pH is one of the most common parameters measured in a wide range of industries.
- The unit of measure for pH is the degree of hydrogen ion activity in a solution or aqueous base medium. The pH scale ranges from 0 to 14.
- Although litmus paper is a common method of pH measurement, it can only provide a rough indication, which might be insufficient in most applications.
- The most accurate method is by using pH meter and electrode with a hydrogen ion-sensitive glass bulb.
- The movement of ions across the membrane produces a voltage that is measured in mV and converted via the pH meter and reflected as a pH value
- Thus, depending on the concentration of the ions in the solution, the mV and hence the pH vary.
- Variations in temperature do have an influence on pH; it is thus important to have a pH meter with Automatic Temperature Compensation (ATC).

Calibration of pH.

- It is important to calibrate you pH meter and electrode before use. Always ensure that you use fresh pH buffers. These must be stored in a dark, cool cupboard at room temperature. This will ensure a shelf life of about 1 year.
- It is recommended to take 20 to 50 ml of the pH buffer, decant into a small container, and use this buffer for 1 month and then discard.
- Then take fresh buffer from the bottle. Never insert the probe directly into the bottle.
- When doing a pH calibration always start off with pH 7 buffer — the neutral point. Then do the calibration on pH 4 buffer followed by pH 10 buffer.
- It is recommended to do a three-point calibration, however it is possible to do a 2-point calibration. When doing a two-point calibration, always start with pH 7 and then pH 4 or pH 10 depending on the range of pH you are working in.

Sample Preparation When Doing pH for Soil.

- The ratio used when doing a sample for preparation on soils is 1:5, i.e., 10 g of soil to 50 ml of rainwater or distilled water.
- Mix the sample for 2–3 min and let stand for about 5 min so that all the salts can dissolve in the solution.
- It is recommended when doing a sample preparation to use $CaCl_2$ instead of rainwater or distilled water as the sample will be more representative of the conditions naturally occurring.
- It is however important to note that the pH will be 0.8 to 2 pH units less depending on the type of soil. The more grey the colour of the soil the greater the pH difference.

Care of pH Electrodes

- As electrodes are used and stored over a period of time, they will experience deterioration in performance.
- By doing a pH calibration at regular intervals (at least once a week), these errors can be corrected. If an electrode is able to be calibrated, is stable and responsive, it is still a functional electrode.

Storage/Shelf life of pH Electrodes.

- Since pH electrodes have a limited shelf life it is important to have a back-up electrode.
- Electrodes must be stored in electrode storage solution and not in water, as the hydrogen ions attach themselves to the bulb of the electrode and this can result in erroneous readings.

Electrode Maintenance

- pH electrodes are susceptible to dirt and contamination and need to be cleaned regularly depending on the extend and conditions of use.
- Wash electrode and reference junction quickly in de-ionised water. Always store the electrode in electrode storage solution.
- Selectech supplies a comprehensive pH electrode "Maintenance and Calibration Kit." This is highly commendable as this will not only ensure accurate and reliable calibrations, which in turn will result in reproducible results, but will also ensure maximum shelf life.

Types of pH Testers

- Pocket types — in a variety of models.
- Hand-held meters — different models to choose from.

THE IMPORTANCE OF CONDUCTIVITY/TOTAL DISOLVED SALTS/SALINITY

Conductivity. Also known as electrical conductivity (EC), conductivity is the capacity of ions in an aqueous solution to carry an electrical current. The basic measurements are milli-siemens·cm^{-1} ($mS \cdot cm^{-1}$) and micro-siemens·cm^{-1} Conductivity is used widely to determine the level of impurities in the water.

Total Dissolved Solids (TDS). Is a mass estimate and is dependent on the mix of chemical species as well as the concentration of chemical species. The TDS can be measured in $mg \cdot L^{-1}$, ppm (parts per million) or ppt (parts per thousand). The TDS concentration can be obtainable by multiplying the conductivity with a factor.

Salinity. Is the measure of the salt levels in the water. Salinity measurements are common in industries like agriculture, aquaculture, hydroponics, food, etc. The results are read as parts per thousand (ppt) or % (1 ppt = 1 $g \cdot L^{-1}$)

Conductivity Calibration Procedure. When doing conductivity calibrations it is important to use conductivity standards prepared for the same salts/chemicals. Select conductivity standards that cover the range you are expecting the conductivity readings to fall into — it is recommended to do a three-point calibration, however a two-point calibration is also possible, starting from the lowest conductivity standard to the highest value. The lifespan of conductivity standards, if stored sealed in a cool dark cupboard is about 1 year, however, once opened the life span is 6 months. It is recommended to take about 20 to 50 ml of sample in a small container. Use this for 1 month and then discard and replenish with fresh conductivity standard. Never place the electrode directly into the bottle of conductivity standard.

Conductivity Soil Sample Preparations.

- Place 10 g of soil in a suitable container and add 50 ml of distilled water or de-ionised water.
- Shake the container and let stand for a few minutes.
- Test the water above soil/sludge level.

Principle of Conductivity Measurements. The principal by which an instrument measures conductivity is via two plates being placed in the same sample and a potential is applied across the plates, and the current is measured. Since the charge of ions facilitates the conductance of electrical current, the conductivity of a solution is proportional to the ion concentration.

Conductivity Temperature Compensation. Conductivity measurements are temperature dependent. The effect of temperature on conductivity depends on the solution being measured. The effect is greatest in low conductivity solutions. A general rule to follow is there will be a 2% difference in conductivity per 1 ^{o}C increase in temperature. It is thus important to choose a meter with temperature compensation.

Conductivity Cell Maintenance. A polarised or fouled electrode must be cleaned to renew the active surface of the cell. In most cases hot water with a mild liquid detergent is an effective cleanser. Acetone easily cleans organic matter and chlorine solutions remove algae, bacteria, and moulds. Never use abrasive or sharp objects to clean an electrode. Care must be taken not to alter the distance between the cells of the electrodes.

Types of Conductivity/TDS Testers

- Pocket types — In various shapes and size and prices.
- Hand-held testers — Also various models available.

Other types of Testers

- Pocket and hand-held salinity testers.
- Combination meters — Measuring pH, temperature, and conductivity.