Salt measurement

The sodium (ions) present in salt that the body requires in order to perform a variety of essential functions. Salt helps maintain the fluid in our blood cells and is used to transmit information in our nerves and muscles. It is also used in the uptake of certain nutrients from our small intestines. The body cannot make salt and so we are reliant on food to ensure that we get the required intake.
The association between salt and blood pressure relates specifically to sodium, however the major dietary source of sodium is sodium chloride i.e. salt.
salt (sodium) is essential to our bodies. Normally the kidneys control the level of salt. If there is too much salt, the kidneys pass it into urine. But when our salt intake levels are very high, the kidneys cannot keep up and the salt ends up in our bloodstream. Salt attracts water. When there is too much salt in the blood, the salt draws more water into the blood. More water increases the volume of blood which raises blood pressure.

The technique is used to measure the salt i.e. ion or electrolyte by:

A. **Electrolyte analyzer**

Measurement of electrolytes

Electrolytes are measured by a process known as potentiometry. This method measures the voltage that develops between the inner and outer surfaces of an ion selective electrode. The electrode (membrane) is made of a material that is selectively permeable to the ion being measured. For example, sodium electrodes are made from a special glass formula that selectively binds sodium ions. The inside of the electrode is filled with a fluid containing sodium ions, and the outside of the glass membrane is immersed in the sample. A potential difference develops across the glass membrane that is dependent upon the difference in sodium concentration (activity) on the inside and outside of the glass membrane. This potential is measured by comparing it to the potential of a reference electrode. Since the potential of the reference electrode is held constant, the difference in voltage between the two electrodes is attributed to the concentration of sodium in the sample.

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Medical Corporation’s EasyLyte® analyzer is a completely automated, microprocessor-controlled electrolyte system that uses ISE (Ion Selective Electrode) technology to make electrolyte measurements. The EasyLyte product line measures combinations of Na^+, K^+, Cl^-, Li^+, Ca^{++}, and pH in whole blood, serum, plasma, or urine.

EasyLyte incorporates state-of-the-art electronics and an innovative ergonomic design that differentiates it significantly from competitors. The analyzer also stores quality-control data that is easily accessible. Patient histories are immediately retrievable for evaluation.

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b. pH meter:

pH meter: is a device used to calculate the pH value by measure potential hydrogen ions when electric current passes through two electrodes (the glass and reference electrode) in closed electric circuit. The pH (always written little p, big H) of a substance is an indication of how many hydrogen ions it forms in a certain volume of water. It is mean power of hydrogen" or "potential of hydrogen." Acids and alkalis are simply chemicals that dissolve in water to form ions (atoms with too many or too few electrons). An acid dissolves in water to form positively charged hydrogen ions (H+), with a strong acid forming more hydrogen ions than a weak one. In clinical chemistry PH value of blood for normal human is 7.34-7.45 according to equation below that maintenance of this value.

$$co_2 + H_2 o \leftrightarrow H_2 co_3 \leftrightarrow Hco_3 + H$$

Parts of pH meter:

1. The calomel reference electrode: consists of a glass tube with a potassium chloride (KCl) electrolyte which is in intimate contact with a mercuric chloride element at the end of a KCL element. It is a fragile construction, joined by a liquid junction tip made of porous ceramic or similar material. This kind of electrode is not easily 'poisoned' by heavy metals and sodium.

2. The glass electrode: consists of silica glass with a thin glass bulb welded to it. Inside is a known solution of potassium chloride (KCl) buffered at a pH of 7.0. A silver electrode with a silver chloride tip makes contact with the inside solution. To minimize electronic interference, the probe is shielded by a foil shield, often found inside the glass

3. Thermistor temperature probe: which allows for automatic temperature correction, since pH varies somewhat with temperature.

4. pH meter converts voltage (potential difference) into pH reading.

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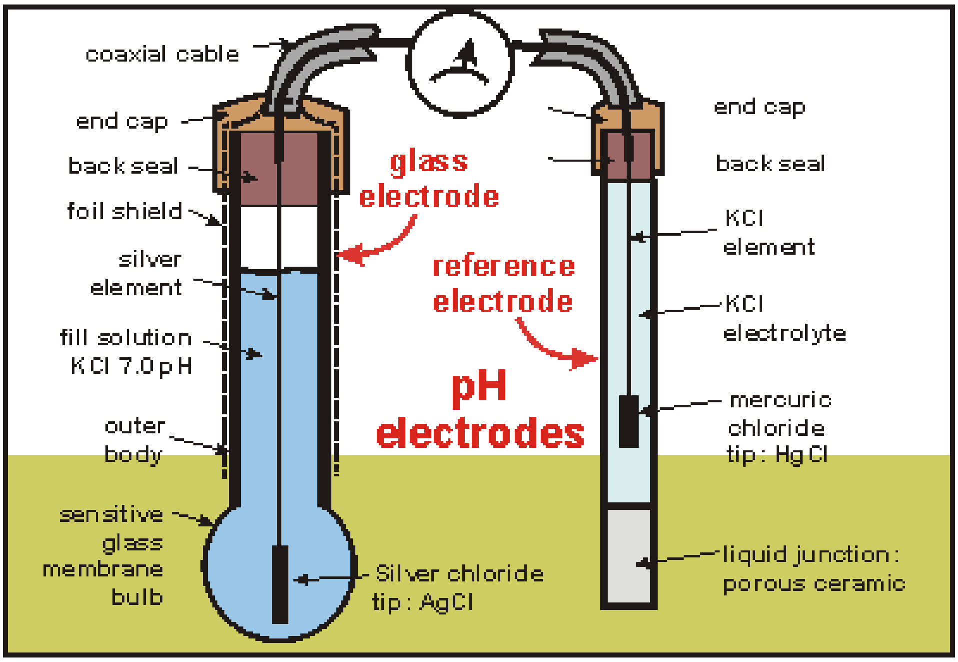


Parts of pH meter

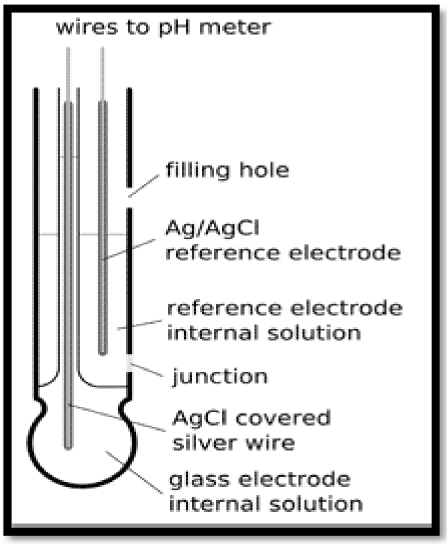
Work of pH meter.

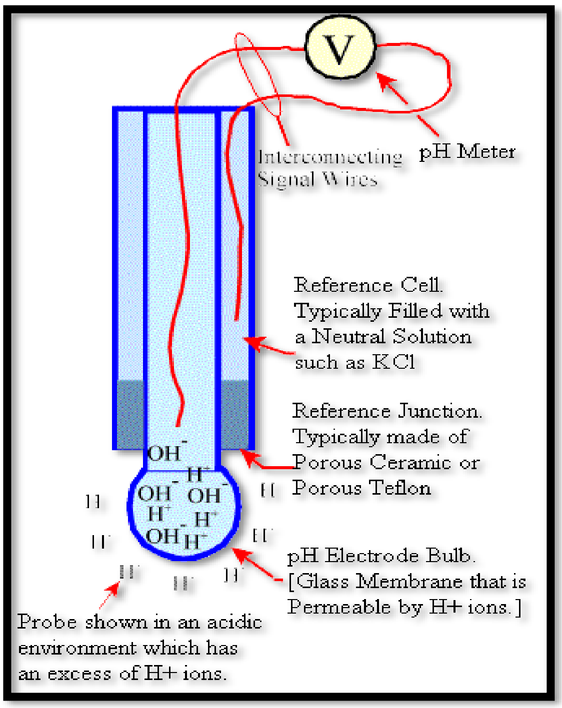
A pH meter measures essentially the electro-chemical potential between a known liquid inside the glass electrode (membrane) and an unknown liquid outside. Because the thin glass bulb allows mainly the agile and small hydrogen ions to interact with the glass, the glass electrode measures the electro-chemical potential of hydrogen ions or the *potential of hydrogen*.

To complete the electrical circuit, also a reference electrode is needed. Note that the instrument does not measure a current but only an electrical voltage, yet a small leakage of ions from the reference electrode is needed, forming a conducting bridge to the glass electrode. The pH meter measures the electrical potential (follow the drawing clock-wise from the meter) between the mercuric chloride of the reference electrode and its potassium chloride liquid, the unknown liquid, the solution inside the glass electrode, and the potential between that solution and the silver electrode. But only the potential between the unknown liquid and the solution inside the glass electrode change from sample to sample. So all other potentials can be calibrated out of the equation. An acidic solution has far more positively charged hydrogen ions in it than an alkaline one, so it has greater potential to produce an electric current in a certain situation—in other words, it's a bit like a battery that can produce a greater voltage.

A pH meter takes advantage of this and works like a voltmeter: it measures the voltage (electrical potential) produced by the solution whose acidity we're interestred in, compares it with the voltage of a known solution, and uses the difference in voltage (the "potential difference") between them to deduce the difference in pH.

Combination of electrode





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pH Probe Calibrations and Maintenance

The success or failure of pH measurement depends on the proper application of the probe and proper subsequent maintenance of the probe. The procedures described within apply to the most common pH probe in use today and that is the flat surface combination pH probe.

The most common failure mode associated with pH probes is breakage. The pH electrode is a very thin glass membrane that is easily damaged. Foreign object damage within the installation or mechanical shock during calibration are often the culprits. The next most common cause of failure is a plugged reference junction. The reference junction consists of a porous material, usually ceramic or Teflon, that must remain open. The junction creates a fluid interface between the reference material which is a liquid and the process fluid. A flow, albeit infinitesimally low, must exist from the reference electrode to the process fluid. In environments where there are high solids, oils or grease this junction can become plugged.

Probe Cleaning

When the reference junction becomes plugged the probe will become sluggish and unresponsive. In many cases the junction can be cleaned with aggressive alkaline cleaners (for oil plugging) or dilute acids (for salt deposits) or a combination of both. In most cases, for probes with large junction surface areas the junction material can be scraped away with a screw driver revealing a new surface. Aggressive procedures are sometimes necessary to bring life back to a dead probe. The glass pH sensing membrane may also require service in some applications. This membrane can become dehydrated or coated with a thin layer of deposits. The best procedure for cleaning or rehydrating the glass is to soak the probe in a pH buffer of 4.0 for several hours. If this does not work then immersing the probe in hot buffer
4.1 solution will usually work.

pH Probe Calibration

Zero point at pH 7

The pH 7 or zero point of an electrode is the pH value at which the total output electrode voltage is equal to 0 mV. In theory, the zero point of a pH electrode happens at the pH value of 7.00. However, in practice, there is almost always a zero point offset. For this reason, a zero-point calibration should always be performed prior to starting a pH measurement.

To perform a zero-point adjustment, you need, for obvious reasons, a buffer solution of the pH-value of 7.00.

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