**Method Summary**

# Determination of pH, EC, TDS, Alkalinity in Water and Leachate using an Automated pH Meter

## Scope and Range

This method details the use of an automated system to measure pH, EC, TDS and Alkalinity in water and leachate samples.
The method is accredited to ISO 17025 for Groundwater, Surface Water, Landfill Leachate, Treated and Untreated Sewages, Trade Effluents, Saline Waters and Potable Waters (non-regulatory) for pH.
The method is also accredited to MCerts for pH for Untreated Sewage, Treated sewage Effluent and Trade Effluent.
The method is accredited to ISO 17025 for Groundwater, Surface Water, Landfill Leachate, Treated and Untreated Sewages, Trade Effluents, Saline Waters and Potable Waters (non-regulatory) for EC.
The method is accredited to ISO 17025 for Groundwater and Surface Water for TDS.
The method is accredited to ISO 17025 for Groundwater, Surface Water, Landfill Leachate, Treated and Untreated Sewages, Trade Effluents and Saline Waters for Alkalinity.

| Method | Range | Reportable LOD |
|---|---|---|
| pH | 2-12 | NA |
| EC | 0-101.119mS/cm | 20µS /cm |
| TDS | 0-2000mg/l | 5mg/l |
| Alkalinity | 0-1000mg/l | 2mg/l |

## References

The measurement of Electrical Conductivity and the Laboratory determination of pH value of Natural, Treated and Wastewaters. HMSO,1978. ISBN 011 751428 4
Standard Methods for the examination of waters and wastewaters 20th Edition, PHA, Washington DC, USA. ISBN 0-87553-235-7.
The Determination of Alkalinity and Acidity in water HMSO, 1981, ISBN 0 11 751601 5.

## Principle

pH:
The term pH is a number that expresses the concentration of hydrogen ions in solution; it is used to express the relative acidity or alkalinity of a solution.
The following equation describes pH in mathematical terms:

$$pH = -\log_{10} [H^+]$$

Where $[H^+]$ is the concentration of hydrogen ions.

In strong acids the concentration of hydrogen ions is very high and acidic solutions display a pH of less

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than 7, whilst the concentration of hydrogen ions in strong bases is low and alkaline solutions display a pH greater than 7. Neutral solutions have a pH of 7.

EC:
Electrical conductivity is a measure of the ability of a solution to allow the flow of electrical current.
Electrical conductivity is measured by determining the A.C. voltage produced between inert electrodes when a constant A.C. is applied.
The conductivity electrode measures resistance in ohms and reports it as the reciprocal unit of milli Siemens/cm (mS/cm) or micro-Siemens/cm (µS/cm).

TDS:
Electrical Conductivity is a measure of a solution's ability to conduct electricity and is reported in units of mS/cm or µS/cm, as required.
The Total Dissolved Solids concentration can be related to the conductivity of the sample.
The conductivity of the solution is measured and multiplied by a factor which converts the result to mg/l TDS.
A factor of 0.7 is used to correspond to the 4:4:2 ratio of Sulphate, Carbonate and Chloride found in natural waters.
This calculated result is only applicable for samples with TDS values of 2000mg/l or less.

Alkalinity:
The sample is titrated with standard acid, to end points of pH 8.3 and/or pH 4.5.
Alkalinity at pH 8.3 represents the titration of all the hydroxide and half the carbonate present in the sample (equations 1 & 3). This is known as the Phenolphthalein Alkalinity and is expressed as mg/l $CaCO_3$.
Alkalinity at pH 4.5 represents the titration of all the hydroxide, carbonate and bicarbonate present in the sample (equations 1, 2 & 3). This is known as the Total Alkalinity and is expressed as mg/l $CaCO_3$.
Titration with acid takes the reactions shown, in equations below, to the right, with ($H_2CO_3$) representing the sum of the concentrations of hydroxide ($OH^-$), carbonate ($CO_3^{2-}$) and bicarbonate ($HCO_3^-$).

**Interferences**

Oil and grease may coat the electrode and cause errors in the pH and EC readings, this interference can be removed by filtering oily samples through glass wool.
Highly saline samples may cause pH to become non-linear; above pH10, the pH 12 check standard must be run if any samples show a pH above 10.
Samples containing high sodium may damage the pH probe.
Samples of low ionic strength may exhibit erratic conductivity readings due to exchange of CO2 and other gases with the atmosphere.