

IQ SensorNet FAQs

Sensor Technology



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Technical Note T629

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1. What is an ISE?

An ion selective electrode (ISE) is an analytical method for measurement of many important substances in environmental samples. ISE instruments consist of a probe, one or more replaceable electrodes, and a meter or controller.

The technology has a long history of use for measurement of pH and ORP. Most recently, ammonium and nitrate online probes have demonstrated great potential for increasing the efficiency of wastewater treatment because of the critical importance of these parameters and the simplicity and versatility of ISE-style probes.

Multiple electrodes can be incorporated into a single probe allowing simultaneous measurement of ammonium and nitrate. They have a wide measuring range from very low to very high concentrations, although, special skills and some additional effort are recommended for monitoring concentrations persistently less than about 1.5 mg N/L. Otherwise, ISE probes are used for monitoring of all stages of the wastewater treatment process from influent untreated wastewater through treated effluent. The required maintenance activities include cleaning, calibrating, and replacing depleted electrodes, with typical cleaning and calibration intervals of weekly and monthly, respectively. YSI IQ SensorNet electrodes for the AmmoLyt, NitraLyt, and VARiON are warranted for 12 months and last up to 24 months, in service, before needing replacement.

2. How can an ORP probe be used for monitoring of nutrient removal from wastewater?

Oxidation reduction potential or ORP is a unique parameter with special characteristics that makes it

especially useful for monitoring biological nutrient removal from wastewater. ORP ranges from -500 mV or lower to +500 mV or greater in biological nutrient removal systems. Very negative values indicate anaerobic conditions necessary for biological phosphorus removal. Maximum positive ORP values indicate oxic conditions with a relatively high DO and complete nitrification of ammonia to nitrate. Intermediate values of ORP following nitrification may indicate anoxic conditions which are necessary for nitrogen removal via biological denitrification. ORP is influenced by many factors so values for oxic, anoxic, and anaerobic conditions are relative for each application. However, in sequencing batch reactors (SBR) and aerobic digesters, the boundaries are indicated by clearly visible changes in slope of the ORP curve allowing programming of aerator operation to maximize nutrient removal and minimize energy consumption.



The VARiON sensor - a rugged ion selective electrode (ISE) probe for the IQ SensorNet monitoring system.

3. What is the online nitrate measurement technology that is best for my application?

It is fortunate that there are a number of practical options for online monitoring of nitrate (NO_3) in wastewater. Cabinet-style wet chemistry analyzers have a long history and are very accurate.

However, they are also complicated and expensive to acquire and operate and therefore, they are not justified for process monitoring purposes where accuracy is less of a concern than repeatability. An ISE-style probe is a good choice for budget-conscious water resource recovery facilities (WRRF) which are seeking to monitor mixed liquor or treated effluent nitrate concentrations from 5 to 100 mg N/L. On the other hand, an ISE-style nitrate probe may not be a good choice for facilities which do not have the resources to perform routine calibrations or to purchase and install replacement electrodes (YSI IQ SensorNet electrodes typically last 18-24 months).

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Optical nitrate probes are a good choice for applications with any of the following requirements: minimal maintenance, monitoring concentrations less than 2 mg N/L, a suspended solids measurement is also desired, nitrite (NO_2) is important. The drawback to optical probes is that they cost about 3 times as much as ISEs. However, ownership costs are lower as electrode replacement is not required. Furthermore, YSI IQ SensorNet optical nitrate probes like the NitraVis and NiCaVis have no parts which require replaced for the lifetime of the instrument.

4. What are the best applications for monitoring turbidity and total suspended solids (TSS)?

The measurement technologies for Turbidity and TSS are similar but the applications are different. Turbidity and TSS are both optical methods which detect the intensity of scattered light. The basic difference in the measurement for online probes is that the detector for turbidity is at a right angle to the light path and the measurement is reported in turbidity units (NTU, FNU or FTU). Turbidity is commonly used in drinking water treatment for process control and sometimes compliance reporting. In the US, only specific designs are accepted for compliance monitoring. The detector for a TSS or TS probe is located at less than a right angle to capture more light which is reflected back in the direction of the light source which allows monitoring of higher concentrations of solids. Also, TSS is reported in mg/L which makes it useful for calculating mass balances and is a critical component of wastewater treatment process control. For other applications where mass balances are not required or the method is not clearly specified, it is recommended to use turbidity because the reference method to verify sensor performance is much simpler and more reliable. The TSS reference method requires special equipment and repeatability and is very hard to achieve, even for experienced analysts.



The IQ SensorNet ViSolid sensor after 30 days

5 - What is the difference between Total Phosphorus and Orthophosphate?

Analytically speaking, the difference between Total Phosphorus (TP) and orthophosphate (OP) is sample preparation. In order to determine TP, unfiltered sample is digested with acid converting all forms to dissolved orthophosphate prior to measurement. The only widely accepted measurement method is colorimetry using either the "blue" method or "yellow" method. TP, measured according to the "blue" method,

is the compliance parameter which is required to be reported to regulatory agencies in the US but TP is not required for process monitoring. Instead, monitoring of dissolved phosphorus provides an indication of the extent of treatment as both chemical and biological P removal methods convert dissolved P to particulate P which is then removed by settling or filtration. The most common online analyzers on the market measure orthophosphate in filtered samples according to the "yellow" method. P in solids is not measured. Therefore, it is

necessary when using online phosphate analyzers to set treatment targets safely below effluent requirements to account for variability in the performance of settling and filtration processes downstream.

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