



BOD testing



BOD testing technologies



BOD testing technology

Biochemical oxygen demand, BOD, measures the amount of oxygen consumed by microorganisms when decomposing organic matter. BOD also measures the chemical oxidation of inorganic matter (i.e., the extraction of oxygen from water via chemical reaction). The BOD test used to measure the amount of oxygen consumed by these organisms can occasionally give operators some trouble.

Briefly, the BOD test consists of an initial and final DO reading. There are several factors that can affect accurate initial and final readings. For greatest success in your BOD test, ensure that the probe is cared for and used properly, the instrument is properly calibrated, and good lab practices are always followed.

Feel free to visit www.YSI.com/BOD to download a Tech Note entitled *How to Ensure Accurate and Successful BOD Measurements*.



Sensor Theory - Optical

Briefly, this technology utilizes optical, luminescence in order to determine dissolved oxygen values. The optical field probes and OBOD™ laboratory BOD probe both work in the same manner.

The optical DO probe measures dissolved oxygen by emitting a blue light of the proper wavelength that causes the sensing element to luminesce, or glow red. Oxygen dissolved in the sample continually passes through the diffusion layer to the luminophore layer, affecting the luminescence in both intensity and lifetime. The YSI sensor measures lifetime of the luminescence as it is affected by the presence of oxygen with a photodiode (light detector) in the probe and compares that reading to a reference.

Optical Technology

Choosing the right sensor/technology for measuring dissolved oxygen (BODs) depends mainly on the preference of the laboratory personnel. Optical, luminescent technology is gaining wider acceptance over traditional electrochemical (membrane covered) sensors due to several factors.

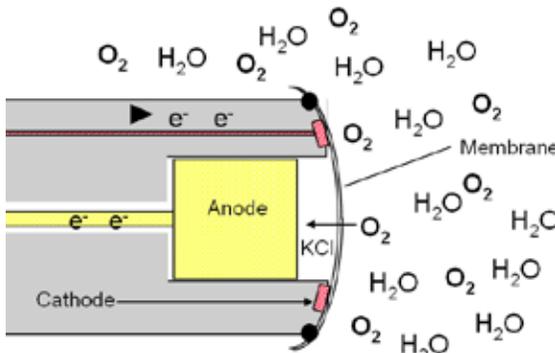
Accuracy: optical sensors are more accurate than membrane covered sensors. This benefit is realized with your blanks. Optical DO sensors have a mg/L accuracy of ± 0.1 mg/L greatly improving the chances of blanks not exceeding the ± 0.2 mg/L threshold level.

Stability: YSI sensors measure the lifetime of the luminescence as it is affected by the presence of oxygen with a photodiode in the probe and compares that reading to a reference. What this means for you is a more stable DO reading calculated by the probe based on a highly stable reference.

Maintenance: optical technology eliminates the need for membrane replacements and anode and cathode maintenance. Even though cap membranes only take seconds to change, they can still cause issues. In addition, since optical sensors don't have anodes or cathodes there is

no sanding or soaking required. The optical sensor only requires that its sensor cap be replaced every 12-18 months. The YSI OBOD probe has a protective sensor guard to prevent the paint layer from being scratched when moving from BOD bottle to BOD bottle.

Approval: EPA approval of changes made to ASTM D888-09 include the addition of Test Method C, which approves the use of luminescence-based optical sensors for dissolved oxygen measurement for all EPA-regulated NPDES, BOD and CBOD measurements.



Sensor Theory - Electrochemical

Briefly, the electrochemical technology utilizes a gold cathode, silver anode, electrolyte solution, and Teflon® or Polyethylene (PE) membrane in order to create a potential across the membrane to measure dissolved oxygen. The oxygen molecules are consumed at the gold cathode after a voltage is applied from the silver anode. In essence, the diffusion rate of oxygen across the membrane is measured. The amount of oxygen diffusing through the membrane is proportional to the partial pressure of oxygen outside the membrane.

Data Troubles

When encountering a problem with BOD values, most operators blame the instrument or probe first. After all, it's what gives you the values! There can be many factors leading to the problem from dirty BOD bottles, DI water, bad seed, bubbles, non-linearity and so on.

Calibration: Regardless of technology, it is recommended to only calibrate the instrument once a day before readings are taken. Make sure there are no water droplets on the probe tip before calibrating and that the probe is in a 100% water-saturated air environment. A BOD bottle with a little water in the bottom is all that's needed. Place the probe back in this bottle when not in use.

Probe Care: Polarographic sensors must have fresh electrolyte and membranes along with a maintained anode and cathode for optimal performance. Optical sensors will need an occasional visual check of the paint layer on the sensor cap.

Warm-Up Time: Polarographic probes require sufficient warm-up time of 5-15 minutes before calibrating and using the probe. Improper warm-up time can easily lead to data drifting due to an inaccurate calibration. Optical probes do not require a warm-up period.

Electrochemical Technology

In 1956, Dr. Leland Clark invented the first polarographic electrode while working with YSI scientists to develop the first DO electrode that was protected from the medium with a membrane. In 1963, this technology was first commercialized by YSI as a portable DO instrument.

Electrochemical technology includes both polarographic and galvanic sensors.

Accuracy: typical electrochemical sensors have an accuracy spec of ± 0.2 mg/L. Be sure to review the *system spec* if comparing products. Some manufacturers only state the instrument

spec without the probe/cable.

Stirring: electrochemical sensors require stirring of the sample in order to overcome the consumption of oxygen at the membrane's surface. The polarographic BOD probes have a built-in stirrer to provide sufficient flow past the membrane. The optical BOD probe's have a stirrer to improve the response time. Stirring also ensures a representative sample in the bottle.

Maintenance: the membrane needs replaced approximately every 2-8 weeks and the anode and cathode

need occasional maintenance (sanding and/or soaking) in order to provide optical performance, stability and accuracy.

Warm-Up Time: the YSI BOD probes use polarographic sensors and require a period of time to warm-up before using. In order to save the working life of the probe, it is recommended that the instrument be turned off overnight but this will require a warm-up time between 5-15 minutes in the morning before the probe and instrument can be calibrated.



BOD Instrument and Probe Ordering Guide

To order or for more information, contact YSI.

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Optical BOD

Option

Order ProODO Instrument Item #626281 (instrument includes Data Manager desktop software and the Pro Comm II communications saddle for data transfer)

Order Optical BOD Probe Item #626400 (U.S. version with U.S. power supply)

or

Order Optical BOD Probe Item #626401 (International version with SAA, EU and BS international outlet adapters and UK BOD funnel adapter)

Polarographic BOD (several options listed below)

Option #1

Order Professional Plus Instrument Item #6050000 (instrument includes Data Manager desktop software and the Pro Comm II communications saddle for data transfer)

Order ProBOD Polarographic BOD Probe Item #605780 (U.S. or international power supply)

Option #2

Order Pro20 Instrument Item #6050020

Order ProBOD Polarographic BOD Probe Item #605780 (U.S. or international power supply)

Option #3

Order 5000 Instrument Item #050022 (U.S. version with 115V power supply)

or

Order 5000 Instrument Item #050023 (International version with 230V power supply)

Order Polarographic BOD Probe Item #050102*

Option #4

Order 5100 Instrument Item #051004 (U.S. version with 115V power supply)

or

Order 5100 Instrument Item #051005 (International version with 230V power supply)

Order Polarographic BOD Probe Item #050102*



YSI BOD Analyst Pro desktop software may be one of the easiest ways to ensure convenient, accurate BOD calculations. Taking human error out of the BOD calculations increases repeatability and improves QA/QC assurance.

Order item #625120

* International probe versions available.