Additional Techniques and Hints for Accurate BOD Results (2nd of 3 BOD articles)

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The previous BOD article reviewed what quality control measures indicate a "good" BOD run. These measures include test-defined limits for the blank, standard, and seed, as well as limits on dissolved oxygen (DO) residuals at the end of the analysis. This article will cover additional techniques and hints to get accurate and valid BOD results.

As with any biological system, pH affects the efficiency of the bacteria breaking down organic matter in the sample. Adjust the pH of all samples for BOD analysis to between 6.5 and 7.5 SU using 1 N sulfuric acid or 1 N sodium hydroxide.

Any sample that has been chlorinated, even if no chlorine residual is left, must be seeded with viable bacteria so that the organic strength, or BOD, of the sample can be measured. Samples that show chlorine residual must also be dechlorinated using sodium sulfite (see Standard Methods for the recipe). But be careful, excess sodium sulfite in the sample will exert an oxygen demand giving false high BOD readings. It's important to remember that the dechlorinating agent for coliform/E. coli analysis cannot be used for BODs. It is not the same chemical.

Most of us use electronic dissolved oxygen probes to measure the DO in the BOD bottles. These probes usually calibrate to an air setting rather than DO saturated water. If your probe is an air calibration type, calibrate to the barometric pressure in your lab rather than to 760 mm (sea level) or to a calculated air pressure based on your topographic elevation (which is commonly done). Air pressure often changes daily and sometimes hourly. Most likely the air pressure is not the same the day of a BOD setup and five days later when the BODs are read again. This will be important when measuring the BOD blank. Since the DO change of the blank should not exceed 0.2 mg/L, you can see where calibration accuracy would aid in validating the analysis.

Bubbles in a BOD bottle also invalidate that bottle's DO measurement. Algae in a BOD sample and left out on a lab bench exposed to sunlight can be a source of bubbles. Always put the BOD bottle in a dark incubator soon after the initial DO is measured and the bottle sealed. But a more common source of bubbles is from dirty glassware. Even though we should try to fill BOD bottles with sample and dilution water as bubble free as possible, there seems to always be tiny bubbles generated. If the glassware is not thoroughly cleaned, then the bubbles stick to the side of the glass and will eventually collect near the bottle's seal during the five-day incubation period.

Another source of bubbles can come from aerated dilution water or from samples that are at a lower temperature than 20 degrees C. Since cold water will hold more dissolved air, aerating cold dilution water will give a higher oxygen content than if the dilution water was aerated at 20 C. After placing the samples in an incubator at 20 C, the water will warm and not be able to hold as much DO. As a result, bubbles may form in the bottles. This can also happen with a low dilution sample, such as an effluent composite sample that was collected at 4 C and not warmed to temperature. It's important to always warm samples to 20 C, then shake the sample to remove excess dissolved oxygen before setting up for BOD. If your laboratory has heating problems, as they all seem to have, try storing the dilution water in your incubator overnight to stabilize the temperature to 20 C. This will help remove excess dissolved oxygen from the dilution water.

As with all analyses performed in your lab, always record the actions of what you do to samples on the data sheet or in a bound notebook specifically for that analysis. For these BOD examples, record sample temperature, pH of BOD sample (before and after adjustment), chlorine residual and amount of dechlorinating agent used (if needed), and the barometric pressure that the BOD probe was calibrated to.

BODs are a lot of work to do. And it's often harder to get them to come out right. With the right techniques and some foresight of potential problems, your results will not only be accurate, but will be valid as well.

The information in this article is based on an EPA accepted test method for NPDES monitoring. As usual, check your federal, state, and local regulations. You may have additional regulations or reporting requirements that you must meet.

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