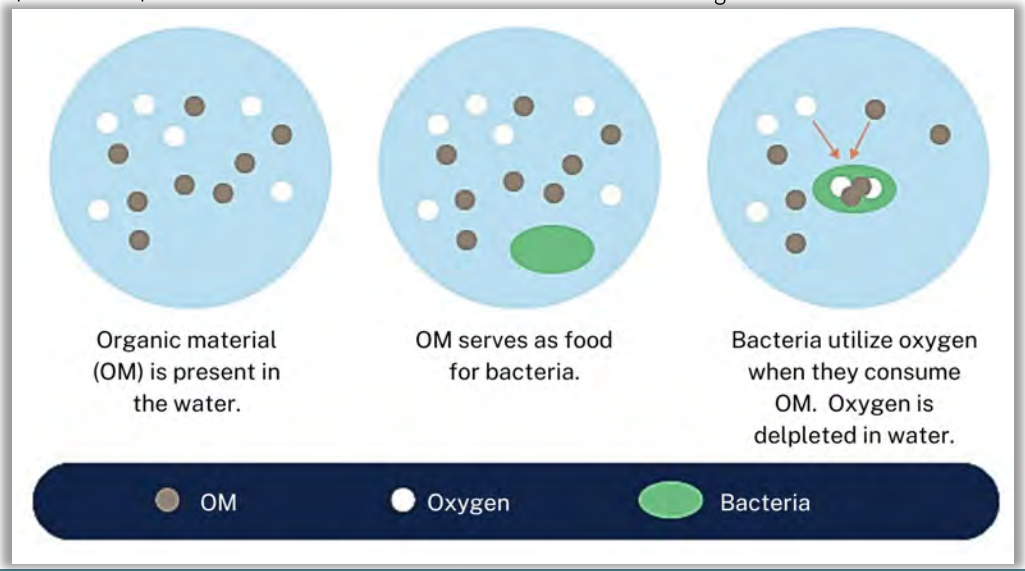
BOD or COD, which do you test for?

While there might be many pollutants on the *IGP Table 2* list that aren't well understood, BOD and COD seem to take the cake. They both measure the demand for oxygen, right? So, what's the difference? Does it matter which one you use? And when the laboratory results come back high, how can you lower your numbers? These are complicated questions, but in this month's edition of **The Rain Events**, we're going to attempt to give some answers.

First, is there actually a real-world difference between COD and BOD? COD stands for chemical oxygen demand, and BOD for biochemical oxygen demand (sometimes also called biological oxygen demand). "BOD, which is primarily used in the United States, and COD, which is used worldwide, both serve as the main benchmarks of measuring the level of pollution (or waste) in a receiving stream. The measurements of BOD and COD are direct representations of the organic/inorganic fractions present in the inflow, as contributed by contaminants coming from the waste processes upstream."[1] BOD is a measurement of the amount of oxygen required by bacteria while stabilizing decomposable organic matter in water under aerobic conditions. COD is the measurement of the total quantity of oxygen needed to completely oxidize all organic matter in the water to carbon dioxide and water. Both of these parameters report the same thing – the amount of oxygen (expressed in milligrams per liter) that is consumed in the sample during the analytical procedure. Higher amounts of organic materials will require more oxygen to oxidize and will result in a higher analytical result. But even though we're discussing BOD and COD as a pollutant, it's important to know that BOD and COD are not actual pollutants in and of themselves – they are indicators of the presence of pollutants. "BOD directly affects the amount of dissolved oxygen in rivers and streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life. The consequences of high BOD are the same as those for low dissolved oxygen: aquatic organisms become stressed, suffocate, and die."[2] Sources of BOD include effluents from pulp and paper mills, wastewater treatment plants, feedlots, food-processing plants; failing septic systems; grass clippings, deicing aircraft or pavements, storing food waste or other waste material outdoors, managing landscaping waste, leaks from dumpsters, fertilizer, herbicide, or pesticide use, sanitary facilities, such as portable toilets, washing equipment with soap containing biodegradable solutions, spills of biodegradable material.[2] "Residual food waste from bottles and cans, antifreeze, emulsified oils are all high in COD and are common sources of COD for industrial stormwater. Water with high COD typically contains high levels of decaying plant matter, human waste, or industrial effluent."[2]



A big difference between BOD and COD is the analytical procedure. The BOD test

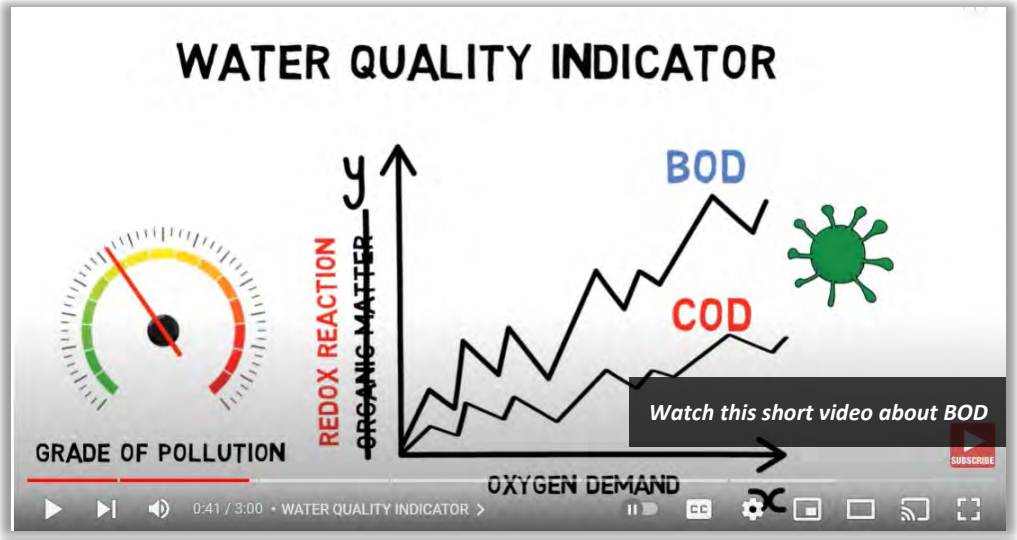
involves introducing a bacteria culture into the sample, and measuring the amount of oxygen consumed by organic compounds as they are oxidized by the bacteria. The BOD analytical procedure takes 5 days. COD uses a strong oxidizer (usually potassium dichromate) to oxidize all of the organic compounds in a sample, while recording the amount of oxygen consumed during the oxidation process. The analytical process for COD is much shorter than BOD, usually lasting around three hours. Because potassium dichromate is a faster and more aggressive oxidizer than bacteria, the COD analysis will return higher numbers than the BOD analysis, especially where there are higher levels of biologically-resistant compounds.

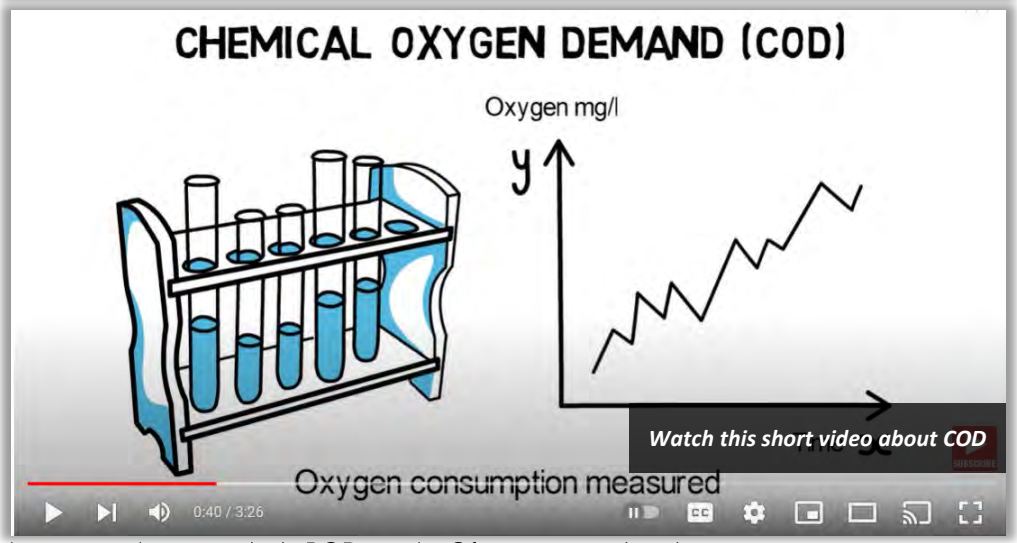
So, which test is more applicable for your facility? It all depends on what pollutants and compounds you are testing for. If the expected pollutants are good food sources for bacteria (i.e., oils, compost, food waste, sewage), then the BOD analysis would be a good fit. The COD analysis should be used when the main expected pollutants are toxic to or are not as easily oxidized by bacteria (i.e., volatile organic compounds, lignans, tannins, etc.)

What could cause elevated BOD and COD levels on a typical industrial facility, and how can you prevent elevated BOD and COD levels? High BOD or COD results come from oxidizing organic matter. What is organic matter? Organic matter is any carbon-based compound found in natural, engineered, terrestrial, or aquatic environment. Organic compounds are extremely numerous, and more varied than you may think. Some of the more common ones include:

- Green waste (leaves, compost, wood chips, sawdust, etc.)
- Garbage and recyclable materials (trash, food waste, cardboard, fats/oils, etc.)
- Petroleum products (motor oil, gasoline, diesel, etc.)
- Vehicle fluids (ethylene glycol, hydraulic fluid, etc.)
- Sugars and alcohols

Remember, oxidizing organic materials sap the dissolved oxygen out of your storm water. If there are any foreign materials in your storm water runoff, you're probably going to have high BOD or COD results. But beware – some elements can give a false positive. For instance, ammonia and phosphates can feed bacteria and cause a high BOD result. Of course, ammonia and phosphorous have their own analytical methods – so if your industrial processes involve either of those chemicals, use the specific analytical method to test for that chemical, not BOD or COD. And keep in mind that while a high sediment load can increase oxygen demand, BOD and COD are not necessarily linked to TSS. We've seen outfalls with TSS numbers in the 40s-50s that have COD results over 400. The best way to prevent high BOD or COD numbers is to prevent your industrial materials from coming in contact with your storm water runoff. Practice good housekeeping, and store materials and equipment under cover wherever possible. Make sure any spills are promptly cleaned up. And take measures to prevent spills and pollution from occurring as preventative countermeasures. Treatment techniques will vary depending on what pollutant is causing your elevated numbers, but trying to lower BOD and COD numbers by treatment can be tricky. Most of the time, it's best to focus on keeping the pollutants out of your storm water, rather than trying to remove it once it already has been introduced. But there are a few advanced treatment systems that can help reduce BOD and COD numbers if you find it's too late for solely preventative measures. See above videos for more information about BOD and COD.





Sources:

[1]https://www.envirozyme.com/resources/blog/what-you-don-t-know-about-bod-and-cod-may-hurt-you

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5 REASONS WHY YOU SHOULD HOST A WORKSHOP

01

GIVE BACK TO THE COMMUNITY

- Instead of making storm water a cut throat industry, take a moment of your time to give back to the community. We've actually seen a lot of competitors become collaborators because of this event.

02

PROFESSIONAL DEVELOPMENT HOURS

- In preparing and presenting a workshop during Storm Water Awareness Week you are actually getting in the professional development continuing education requirements you need to meet!

03

NETWORKING OPPORTUNITY

- Ever been to a storm water conference where you are running into people and trying to network with people who are in your same position? Storm Water Awareness Week is catered to the people who need the education and not just other vendors and consultants.

04

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- By hosting a Storm Water Awareness Week workshop you are investing in the future of storm water. Providing education to those who are actively involved in keeping water from their sites clean. Time well spent in our opinion.

05

IT'S FUN

- Who says education has to be boring? Get as creative as you want with your presentation! Take a field trip. Make a video. Do experiments. Try out products. Install BMPs. The sky is the limit.

Storm Water Contest...

Each month, we invite our readers to participate in a contest to test their knowledge of the Industrial General Permit and show their storm water compliance program. We enter all submittals to our monthly newsletter question into a drawing and one person is selected at random to receive a $25 gift card. Last month's contest question was:

When is the deadline for Annual Reports?

Congratulations to Trisha who replied *"Deadline for Annual Reports = July 15th."* Trisha, we hope you enjoy some delicious ice cream during this summer heat wave!

...This Month's Contest

What is the difference between BOD and COD?

We need industrial storm water sleuths to help us with this month's question. Submit your answers by Friday, August 11th. Email your answer to jteravskis@wgr-sw.com. One winner will be selected by a random drawing to receive a $25 gift card to Amazon.

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