

## **BOD (biochemical oxygen demand)**

Biochemical Oxygen Demand (BOD, also called Biological Oxygen Demand) is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period.

BOD can be used as a gauge of the effectiveness of wastewater treatment plants. BOD is similar in function to chemical oxygen demand (COD), in that both measure the amount of organic compounds in water. However, COD is less specific, since it measures everything that can be chemically oxidized, rather than just levels of biodegradable organic matter.

Most natural waters contain small quantities of organic compounds. Aquatic microorganisms use some of these compounds as food. They use dissolved oxygen to degrade the organic compounds by oxidation, releasing energy which helps in their growth and reproduction. This microbial metabolism creates an oxygen demand proportional to the amount of organic compounds used as food by them. Under some circumstances, microorganisms can consume dissolved oxygen faster than the dissolution of atmospheric oxygen into water or than the algae etc. can produce. Fish and aquatic insects may die when oxygen is depleted by microbial metabolism. Biochemical oxygen demand occurs over some variable period of time depending on temperature, nutrient concentrations, and the enzymes available.

The BOD value is most commonly expressed in milligrams of oxygen consumed per litre of sample during 5 days of incubation at 20 °C and is often used as a measure of the degree of organic pollution of water.

### **BOD Testing**

BOD is the traditional, most widely used test to establish concentration of organic matter in wastewater samples (i.e., relative strength).

BOD is based on the principle that if sufficient oxygen is available, aerobic biological decomposition (i.e., stabilization of organic waste) by microorganisms will continue until all waste is consumed.

The BOD test is also known as "BOD5" since it is based on the accurate measure of DO (dissolved oxygen) at the beginning and end of a five-day period in which the sample is held in dark, incubated conditions (i.e., 20°C or 68°F).

The change in DO concentration over five days represents the "oxygen demand" for respiration by the aerobic biological microorganisms in the sample.

The five-day completion window is a disadvantage of the test because wastewater treatment system personnel cannot use it to make real-time operational adjustments.

An extended UBOD (ultimate BOD) test that measures oxygen consumption after 60 days or more is sometimes required in wastewater permits.

## **COD (chemical oxygen demand)**

COD measures the oxygen required to chemically oxidize all the organic compounds in water. So a COD test can be used to easily quantify the amount of organics in water. The most common application of COD is in quantifying the amount of oxidize-able pollutants found in surface water (e.g. lakes and rivers) or wastewater. COD is useful in terms of water quality by providing a measure to determine the effect which an effluent will have on the receiving water body, much like biochemical oxygen demand (BOD). The basis for the COD test is that nearly all organic compounds can be fully oxidized to carbon dioxide with a strong oxidizing agent under acidic conditions.

### **COD Testing**

COD is the most popular alternative test to BOD for establishing the concentration of organic matter in wastewater samples.

The COD test only takes a few hours to complete, giving it a major advantage over the 5-day BOD test. Wastewater treatment system personnel can use COD as an almost real-time operational adjustment parameter.

COD can test wastewater that is too toxic for the BOD test.

The COD test should be considered an independent measure of the organic matter in a wastewater sample rather than a substitute for the BOD test.

The COD test uses a chemical (potassium dichromate in a 50% sulfuric acid solution) that “oxidizes” both organic (predominate) and inorganic substances in a wastewater sample, which results in a higher COD concentration than BOD concentration for the same wastewater sample since only organic compounds are consumed during BOD testing.

The most popular current testing method for COD involves using sealed and heated low-range (3-150 ppm) or high-range (20-1500 ppm) pre-prepared vials that change color from orange to green based on the amount of oxidation and that are read using a laboratory colorimeter