

FACT SHEET



Carbon analysis and oxygen demand

carbon analysis & oxygen demand

The carbon content of a water sample and its biological or chemical oxygen demand are directly related to each other, however these parameters can be measured in different ways. The exact relationship between these parameters for each type of sample will vary with sample composition. Definitions of these analytes and how they relate to each other are given below.

water testing for total organic carbon

Total Organic Carbon (TOC) is measured on a dedicated instrument by acidification and purging of the water sample to remove dissolved carbon dioxide, bicarbonate and carbonate as carbon dioxide gas. This is followed by ultraviolet, chemical or thermal oxidation of all organic carbon present in the sample to form carbon dioxide.

The evolved carbon dioxide is usually measured with a non-dispersive infrared analyser. Carbon measured by this process is non-purgeable organic carbon (NPOC), since some volatile organic compounds present in the water may be removed during the purging process along with the dissolved carbon dioxide.

In practice, most organic carbon compounds in waters are not lost in this fashion and NPOC can be considered the same as TOC.

TOC measurement is particularly important for potable waters undergoing chlorination where organic carbon compounds in the water generate toxic materials such as chloroform.

water testing for total inorganic carbon

Inorganic carbon consists of carbon derived from carbonates, hydrogen carbonates and dissolved carbon dioxide. Total Inorganic Carbon (TIC) is measured by analysing the evolved CO₂ upon acidification and purging of the water sample.

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water testing for filterable organic carbon

Filterable Organic Carbon (FOC) is a TOC measured on a sample filtered to 0.45 microns before analysis. It removes the influence of suspended material on the TOC result. Since the injection volumes taken for analysis of TOC are small, suspended material can introduce a large degree of variability to results.

water testing for biological/ biochemical oxygen demand

Biological (or Biochemical) Oxygen Demand (BOD) a measurement of the oxygen consumed by bacteria in the water over five days with the bacteria using the organic material present as a food source.

Samples are seeded with bacteria and a nutrient solution (containing largely nitrogen and phosphorous) and incubated for five days. During this period, the aerobic bacteria consume oxygen and convert the organic carbon compounds to carbon dioxide.

BOD is usually used as a key measurement for sewerage discharges and waste effluents. A high BOD sample discharged into aquatic environments will deplete the water of oxygen which in may result in fish kills.

water testing for chemical oxygen demand

Chemical Oxygen Demand (COD) measures the amount of oxygen equivalents taken to chemically oxidise the sample using a powerful oxidising agent (dichromate).

The sample is reacted by boiling under acidic conditions with potassium dichromate to fully oxidise all material present. As for BOD, results are expressed in mg/L Oxygen.

For any water sample, the COD value is always greater than the BOD result because the reaction also incorporates all other oxidisable material such as organic nitrogen compounds, ferrous iron etc. (rather than just the organic carbon compounds).

Particular types of sample have a consistent relationship between the BOD and COD.

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