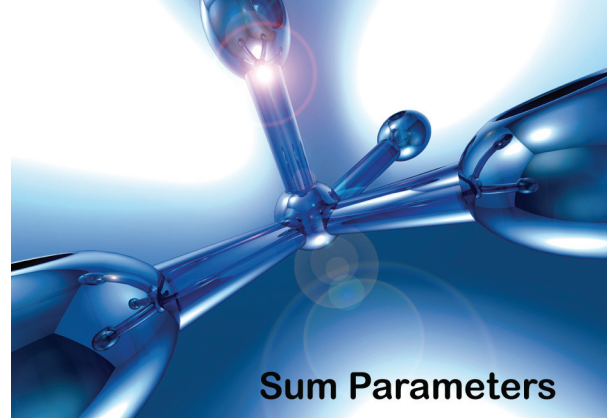


Application Note

Information on relationships between common parameters: COD, BOD, TOD and TOC



Sum Parameters

Are all wastewater related parameters measurable with one instrument?

The knowledge about the organic pollution of wastewater is a basic requirement for the evaluation, design, operation and controlling of the treatment process. For this purpose are many terms in use that relate to the oxygen demand and/or organic carbon content of the wastewater.



TOC lab-analyser

BOD, Biological Oxygen Demand

The BOD is an indicator of the fraction of organic matter that may be degraded by microbial action at a given time period at a temperature of 20°C.

The BOD test is too slow to provide timely information to the operator for control purposes. It should also be noted that, when ammonia is present in the test sample, there could be a significant increase in measured BOD as a result of microbial oxidation of the ammonia (ultimately to NO₃).

COD, Chemical Oxygen Demand

This is the amount of oxygen required for the chemical oxidation of compounds in water, as determined using a strong oxidant (most standard methods use dichromate).

Besides to the organic compounds, nitrite, bromide, iodide, certain metal ions and certain sulphur compounds can be determined as COD. In addition some organic molecules (e.g., benzene) are relatively resistant to dichromate oxidation and may give a falsely low COD.

TOD, Total Oxygen Demand

This is measured by the consumption of oxygen for oxidation of the sample to stable end products in a platinum-catalyzed combustion chamber.

TOD also responds to non-carbonaceous oxygen demand contributors such as nitrogen and sulphur containing compounds. The result is affected by the interference of Nitrogen compounds present in the waste water

TOC, Total Organic Carbon

This is a direct measure of organic carbon in a sample. It is determined by oxidation of the organic carbon compounds (after removal of inorganic carbonates) and detection of the carbon dioxide produced.

The organic determination is free of many variables involved in the BOD, COD and TOD analysis.

Standardisation of the parameters

TOC, Total Organic Carbon	COD, Chemical Oxygen Demand	BOD, Biological Oxygen Demand	TOD, Total Oxygen Demand
<ul style="list-style-type: none"> ○ Standard Method 5310B ○ EPA 415.1 ○ EPA 9060A ○ ASTM D2579 ○ ISO 8245 ○ EN 1484 (replace of the DIN 38409-3) 	<ul style="list-style-type: none"> ○ DIN 38409 Teil41/43/44 ○ ISO 6060 ○ EPA 410.4 ○ DIN ISO 15705 	<ul style="list-style-type: none"> ○ DIN EN 1899-1 ○ DIN EN 1899-2 ○ ISO 5815 ○ EPA 405.1 ○ Standard Method 5210B 	Not known

Correlation between the different parameters

- Generally COD values are higher than BOD values. The reason is that biochemical oxygen demand measures only the quantity of organic material capable of being oxidized, while the chemical oxygen demand represents a more complete oxidation.
- TOD will be equivalent to COD except in those cases where the other compounds are oxidised as by the COD test method.
- The COD/TOC correlation factor is different for each effluent.

Theoretically COD/TOC-relation: 2,67
(based to O₂/ C-relation)

In several cases the ratio could be

- high as 3.5 (inlet water, non-carbon compounds are determined too)
- low as 2.5 (outlet treated water; decreasing of the dichromate oxidizability of the organic residues after the biological oxidation)

Conclusion

The determination of each parameter is different and influenced by diverse compounds of the wastewater. Due to this, a simple conversion (calculation with factors) from one parameter to another is difficult. The relationship between many of the parameters is empirical. Precise values depend on the matrix influence, molecular structure and potential of oxidation.

The Shimadzu TOC instruments meet all the needs of modern TOC analysis – regarding performance, variety of systems and methods. Shimadzu's know-how and experience for decades have been integrated in the systems.



TOC-process analyser