



## Carbon

### Carbon

The main task of a waste water treatment plant is to reduce the total organic load of waste water in addition to all the progress made in nitrogen and phosphate elimination. Organic compounds consist mainly of the elements carbon and hydrogen. The cleaning process converts them to carbon dioxide and water while consuming oxygen.

#### Carbon parameters:

**TOC:**

A measure for the total organically bound carbon

**DOC:**

Dissolved organic share of TOC

**COD:**

Contains all substances that can be solubilized by chemical oxidation. It is at the same time the conventional parameter for the calculation of wastewater charges

**BOD:**

Contains only the compounds that can be oxidated microbiologically

#### Carbon parameters

To measure the organic load of water, the parameters TOC, DOC, COD or BOD are used. The differences of these parameters (marginal column) show that these measurements are not identical and that the measured values therefore can not be equal.

#### Analysis procedures

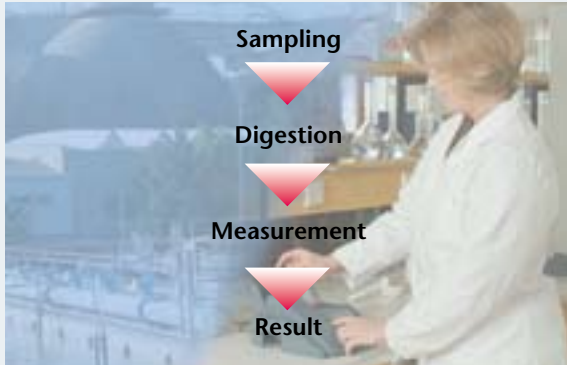
For an analytical online determination, all these parameters require complex procedures for digestion and the corresponding instrumentation.

#### SAC

The SAC (spectral absorption coefficient) is a parameter that can be determined more easily. Many organic compounds have characteristic UV absorption spectrums. The intensity of the light attenuation can, therefore, be correlated with the organic load.

This correlation is significant in measuring media with low variations of composition concerning color, solids and their

## COD measurement in the laboratory



### Individual measurement

=> time-delayed,  
suitable for monitoring

## In-situ measurement

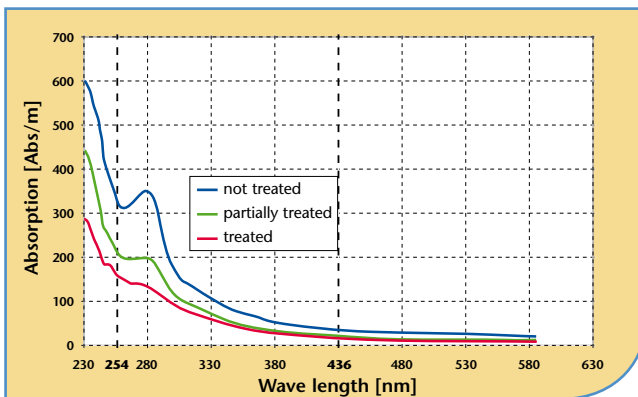
using a spectrometer sensor



### Continuous measurement

=> fast response time,  
suitable for control strategies

optical characteristics. Waste water, however, contains many substances with completely different optical characteristics. For each substance, a different correlation factor concerning the carbon content applies. Measuring at only one wavelength, e.g. at 254 nm for the SAC<sub>254</sub>, can often show the load only inadequately – especially if the matrix changes.



Spectrum of waste water samples of a waste water treatment plant:

The measured absorption spectrum of this waste water treatment plant shows a characteristic maximum at approx. 280 nm that is caused by dissolved, biodegradable substances (they are degraded during the cleaning process; the absorption peak disappears nearly completely).

Measuring the SAC at 254 nm cannot include these compounds, as the absorption is nearly exclusively caused by solids in this range and there is no correlation with the dissolved, degradable ingredients at this wavelength.

### On-line spectrometer probes

The CarboVis® and NiCaVis® sensors measure the total spectrum range from ultraviolet to long wave visible light.

The measured values are determined from the high information content of the spectral data. The calculation is based on methods and characteristics that were achieved from a multitude of measurements and longtime analyses. The user can, therefore, select algorithms that are adapted to the measuring site (inlet, outlet etc.) having a high correlation with the basic parameter COD.

The spectral procedure has an additional advantage: the turbidity of the test sample, which affects optical measurements, is optimally compensated over a wide wavelength range.

The determined measurement result is displayed directly as **mg/l COD**. A known correlation between this basic parameter COD and one of the related carbon parameters (TOC, DOC or BOD, to be selected) can be set by means of a user-specific calibration. The result is then displayed directly as, e.g. mg/l TOC.

### Applications

The most important measuring points of waste water treatment plants are the inlet and outlet.

To determine the incoming load of the plant, a CarboVis® sensor is positioned in the inlet. The load found in the outlet of the plant is low. With a “CarboVis®” installed there (possibly with integrated total suspended solids measurement), the cleaning performance of this plant can be monitored well. The NiCaVis® combination sensor is also suitable for the outlet. It measures the carbon content as well as the nitrate concentration.

## CarboVis®/NiCaVis® System

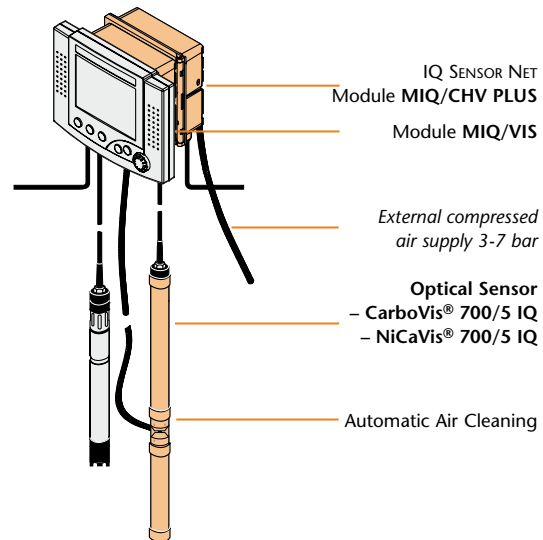
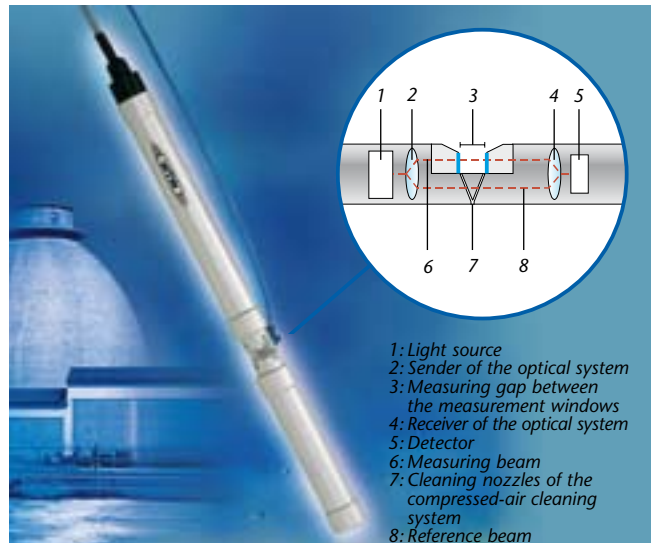
- In-situ measurement – fast response
- No consumables
- No ecologically harmful chemicals

### in-situ measurement of Nitrate, COD, TOC, DOC, BOD or SAC (254 nm): High quality spectral measurement in a waterproof version for direct process control

Highly precise spectral measurement in a 1.57 in. (40 mm) in diameter sensor. Determination of measured values by spectral processing of the scanned UV/VIS spectrum. The TSS result is generally used for internal compensation. As an option the TSS value can be displayed as second parameter.

#### Features in detail:

- The sensor measures directly in the process medium. No sample transport, no sample preparation necessary.
- No lag-time between sampling and result of the measurement. Current values immediately available.
- Extremely precise measurement due to the spectral analysis of the scanned UV/VIS range.
- Very effective compensation of interferences and turbidity based on the spectral information – much better than a simple dual-beam measurement!
- Long operation periods by automatic air cleaning – almost maintenance-free.
- Optical system works without consumables -> low costs of ownership.



required components per measuring place: orange





VIS Set-EH/F in use



VIS Set-Inlet in use

Accessories see page 110.

### Technical Data CarboVis® /NiCaVis® System

Measuring Principle	Spectral measurement in the UV/VIS range (200 - 750 nm)		
	CarboVis® 700/5 IQ	CarboVis® 700/1 IQ	NiCaVis® 700/5 IQ
Applications	Municipal wastewater: inlet, effluent		Municipal wastewater: effluent
Measuring Ranges in Standard Solution (potassium-hydrogenphthalate)	COD: 0.1 ... 800.0 mg/l TOC: 1 ... 500.0 mg/l SAC: 0.1 ... 600.0 1/m	COD: 0.5 ... 4000.0 mg/l TOC: 5 ... 2500.0 mg/l SAC: 0.5 ... 3000.0 1/m	COD: 0.1 ... 800.0 mg/l TOC: 1 ... 500.0 mg/l SAC: 0.1 ... 600.0 1/m NO <sub>3</sub> -N: 0.01 ... 25.00 mg/l
Accuracy in Standard Solution	±3 % of the measured value ±2.5 mg/l (with Check algorithm)		
Measuring Ranges TSS (Option)	Inlet: 0 ... 3000 mg/l TS Effluent: 0.0 ... 900.0 mg/l TS	Inlet: 0 ... 15 g/l TS Effluent: 0 ... 4.5 g/l TS	—
Materials	Gehäuse: Al Mg Si 1, anodisiert (eloxiert) Messfenster: Saphirglas		
Pressure Resistance	≤1 bar		
Ambient Conditions	Housing: Al Mg Si 1, anodized Windows: Sapphire glass		
Flow Velocity	≤3 m/s		
pH Range	pH 4 ... pH 9		
Salt Content of Medium	< 5000 mg/l (Chloride)		
Dimensions	25.59 x 1.73 in. (650 x 44 mm, length x max. diameter)		
Weight	Approx. 2.4 pounds (1.1 kg)		
Guaranty	1 year for defects of quality		

### Ordering Information

	All sensors with 49 ft. (15 m) cable and compressed air tubing	Order No.
CarboVis® 700/5 IQ	Optical COD/TOC/DOC/BOD/SAC probe with spectral processing of the UV/VIS range; path length 5 mm.	481 025
CarboVis® 700/5 IQ TS	same as model CarboVis® 700/5 IQ, additionally with TSS measurement.	481 026
NiCaVis® 700/5 IQ	Optical probe for measuring Nitrate and COD/TOC/DOC/BOD/SAC with spectral processing of the UV/VIS range; path length 5 mm.	481 027
MIQ/VIS	Connection module for UV/VIS sensor; directly controls the valve module for compressed air cleaning	481 029
MIQ/CHV PLUS	Cleaning head valve for automatic air cleaning; directly controllable via the IQ Sensor Net bus	480 018
DIQ/CHV	Valve module for automatic compressed air cleaning for system 182; accessible by means of a DIQ/S 182 relay	472 007

