Continuous determination of organic loading in wastewater

Advantages

- **No sample extraction**
- **Instant measurement**
- **No reagents**
- **Low-maintenance**
- **Self-cleaning system for operational reliability**

The UVAS sc Sensor is a patented method for the continuous measurement of UV absorption (dissolved organic substances in water), in conformity with DIN 38404. In water analysis, UV absorbance measurement is a rapid, low-cost and environmentally-friendly alternative to continuous DOC/TOC measurement and COD determination. Through measurement directly in the water, the possibility of errors due to sample conditioning are eliminated.

Measuring Principle

The UVAS sc uses the absorption of ultraviolet light at 254 nm to measure the dissolved organic compounds in the water. Different pathlengths are available for different applications and concentrations of dissolved organics. A reference measurement at 550 nm is used to compensate for any particles in the sample which also absorb the UV light. A wiper provides self cleaning for the quartz glass windows in the measurement pathlength.

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Summing parameters

The parameters COD, BOD, TOC, and SAC are all summing parameters that measure an entirely specific, although not fully identical, aspect of organic concentration. Whereas BOD measures substance groups that are accessible to microbial oxidation, COD represents substances that are accessible to chemical oxidation. By contrast, TOC records the total organic content, and SAC focuses on the substances that absorb UV radiation (see Figure 1).

The user must therefore decide which summing parameter and measuring process are best suited to the specific application, so that the results will provide a useful basis for the monitoring and closed-loop control of the wastewater plant.

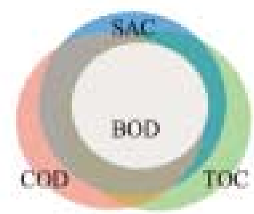
Parameter	Measured variable	Measuring method	Substance groups measured
BOD Biochemical oxygen demand	O_2 -consumption	Microbial oxidation	
COD Chemical oxygen demand	O_2 -consumption	Wet chemical oxidation	
TOC Total organic carbon	C -concentration	Thermal, wet chemical digestion	
SAC Spectral absorption coefficient	UV absorption at λ =254 nm	UV absorption measurement	

Fig 1: Typical summing parameters

Comparison between SAC and TOC/COD

Numerous scientific studies have proved the comparability between SAC and COD or TOC. Some experts obtain a correlation factor of 0.94 or 0.98 between COD and TOC in measurements in the primary settling tank. They also show that "UV-absorption has an excellent correlation to COD in wastewater treatment plants."

Figures 2 and 3 show sample progress graphs for COD or TOC together with the SAC progress line for the inflow to a local authority plant, and for a main sewer in the drain network of a city with a high concentration of industrial effluent. The deviation on the first day in Figure 2 indicates a high solids concentration, which had to be detected by an additional solids measurement.

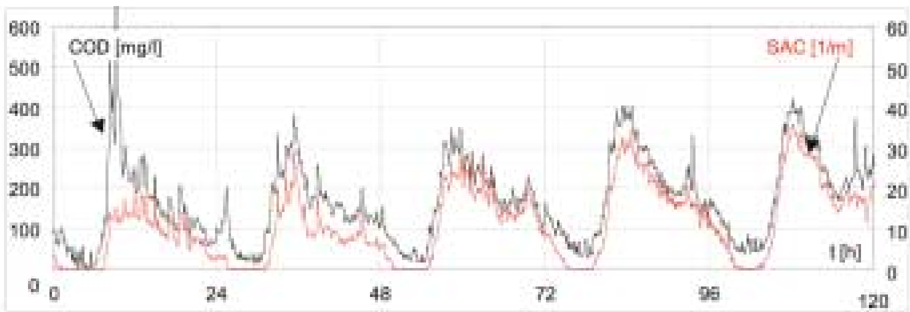


Fig 2: Comparison of SAC and COD progress lines for a local authority wastewater works

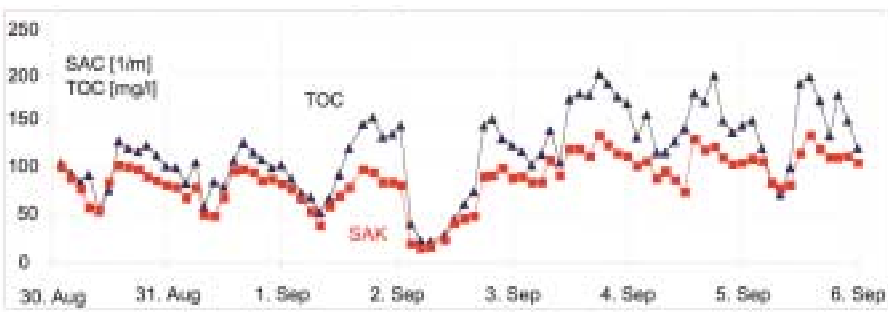


Fig 3: Comparison of SAC and TOC progress lines

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Optimization of outflow processes in the drains

The UVAS sc permits direct measurement of the organic pollutant content of wastewater in a collection system, thereby establishing the basic conditions for:

- *Quantification of organic load discharged into the receiving water body by the sewer network*
- *Load-dependent management of rain basins*
- *Use of accumulation capacity in the sewer network to even out peaks and troughs in pollutant inflow*
- *Monitoring of indirect inlet lines*

Figure 4 shows a measurement arrangement for this type of application at a rain overflow basin. In order to measure undissolved contaminants, the SOLITAX® sc Suspended Solids and Turbidity Analyzer is also used here.

Fig 4: UV process and turbidity probe

Measurement of wastewater strength in the sewer network

Figure 5 shows the continuously measured organic concentration of wastewater at a spillway in a drain network over a period of 4 days. Measurements were taken with the UVAS sc. In addition, as a measure of the volumetric flow, the height of overflow above the spillway is shown.

From the 5th to the 8th of October, dry weather effluent predominated, with corresponding regular variations in organic concentrations and wastewater flow over the course of each day.

Midday on the 8th of October, after a long period of dry weather, a rain event caused a large increase in wastewater flow. This increase was initially linked to a sudden rise in the pollutant content of the wastewater to values of about SAC=120m^{-1} (flush surge).

Subsequent dilution of the dirty water with rainwater reduced the wastewater pollution to levels rarely attained even at the plant outfall (SAC=10m^{-1} equivalent to COD=20mg/L). Similar dilution effects are also observed over the next few days. However, due to the previous rain incidents, no flush surges occur.

The conditions observed here show that it may be advantageous to discharge the highly diluted mixed water directly rather than channeling it through the wastewater plant.

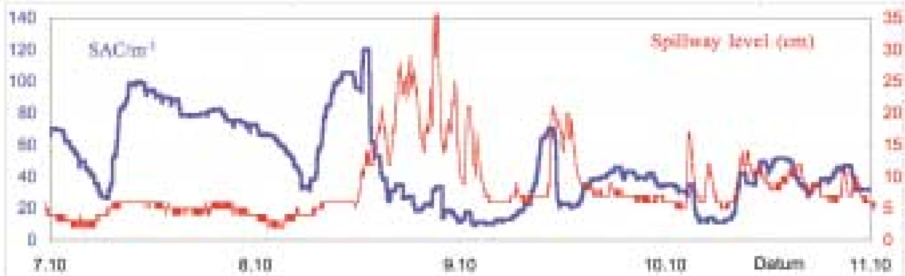

Fig 5: Variation of wastewater pollution and wastewater flow in rainy weather

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To manage the wastewater treatment process efficiently, accurate knowledge of the organic levels in the wastewater is particularly important. The UVAS sc can provide this information.

Monitoring of the treatment plant inlet

Figure 6 shows a sudden rise in the incoming organic load at the inlet of the wastewater plant. This high inlet level led to the COD limit being exceeded at the plant outlet. Since the process was recorded by a UV process probe, the cause of this excess could be determined.

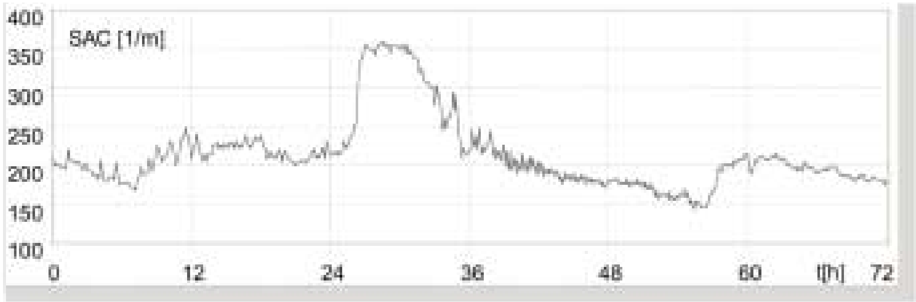

Fig 6: Progress graph of SAC over time at the inlet of a wastewater plant with indirect inlet.

Addition of centrate water

Figure 7 shows the graph of organic concentration at the inlet of a local authority plant. The peaks in organic levels identify when the process water was added. In the future, these peaks will be prevented by adding the process water only during periods of otherwise low inlet loading.

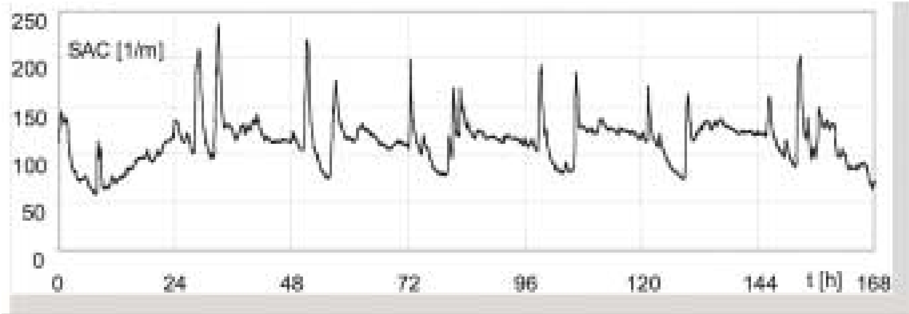

Fig 7: Progress graph of SAC over time at the inlet of a wastewater plant

Monitoring the plant effluent

The UVAS sc also provides an inexpensive means of establishing a gap-free record of organic loading at the outlet of the wastewater plant. Figure 8 shows an example of the graph for a wastewater plant effluent. The UVAS sc permits ultra-fine differentiation in the range of approximately 20-30 mg/L COD.

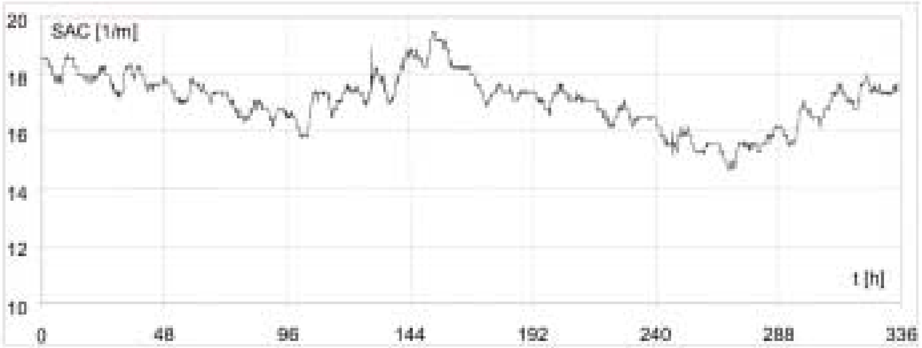

Fig 8: Progress graph of SAC over time at the outlet of a wastewater plant

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