

Application Specification

UV Process Probe UVAS[®] plus

Continuous determination of organic pollutants in wastewater



Figure 1: UVAS[®] plus

The UV Process Probe UVAS[®] plus (Figure 1) is a patented development from Dr. Lange GmbH & Co. KG for the continuous measurement of the UV absorption of dissolved organic substances in water, in conformity with DIN 38404. In water analysis, pure physical extinction measurement is a rapid, low-cost and environment-friendly alternative to continuous DOC/TOC measurement and COD determination.

Through direct measurement in-situ – i.e. directly in the medium itself, in this case water – the possibilities of errors due to sample conditioning are eliminated. The measured value is available without delay and can be expressed as the spectral absorption coefficient (SAC) in m^{-1} in accordance with DIN 38402 or, after establishing a correlation, in mg/l COD_{UV} or mg/l TOC_{UV}/DOC_{UV} .

- ◆ No sample extraction
- ◆ Delay-free measurement
- ◆ No reagents
- ◆ Low-maintenance
- ◆ Self-cleaning system for operational reliability
- ◆ High availability
- ◆ 5-year warranty on flashlight
- ◆ MULTI UNIT plus with second probe input (e.g. for measuring turbidity)

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Sewage plant applications



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To manage the sewage treatment process efficiently, accurate knowledge of the pollutant levels in the wastewater is particularly important. The UVAS[®] plus UV process probe can provide this information:

- ◆ Detecting sewage plant inflows containing high organic pollutant levels without delay,
- ◆ Adding internal process waters and external c-sources to the cleaning process as a function of the pollution levels at the inlet,
- ◆ Gap-free monitoring of the sewage plant outfall and of wastewater purification performance

Monitoring of the sewage plant inlet

Figure 7 shows a sudden rise in the incoming pollutants at the inlet of the sewage plant. This high inlet level led to the COD limit being exceeded at the sewage plant outlet. Since the process was recorded by a UV process probe, the cause of this excess could be determined.

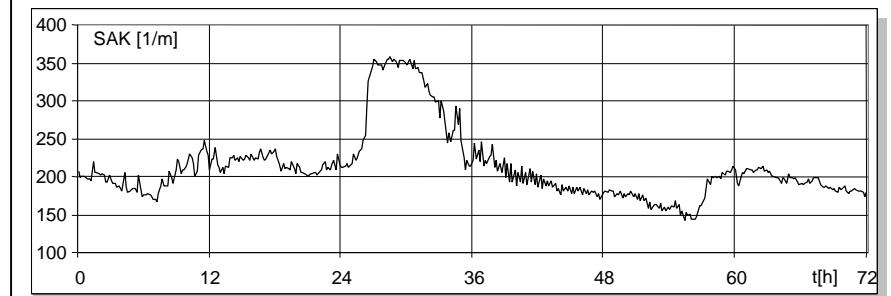


Figure 7: Progress graph of SAC over time at the inlet of a sewage plant with indirect inlet

Addition of centrate water

Figure 8 shows the progress graph of organic pollution at the inlet of a local authority sewage plant. The times when process water is added can be identified from the peaks in pollution levels. These peaks will in future be prevented by adding the process water only during periods of otherwise low inlet pollution.

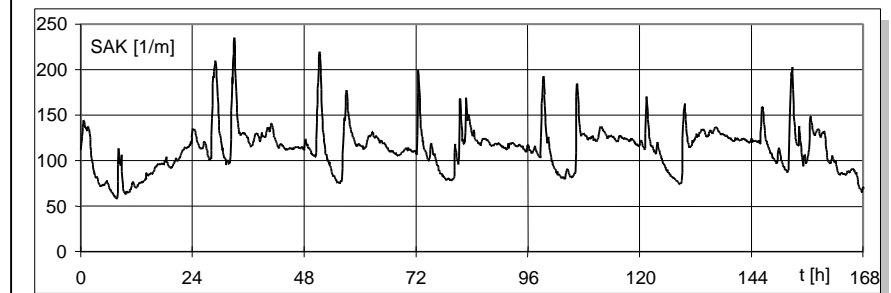


Figure 8: Progress graph of SAC over time at the inlet of a sewage plant

Monitoring the sewage plant outfall

The UVAS[®] plus also provides an inexpensive means of establishing a gap-free record of organic wastewater pollution at the outlet of the sewage plant. Figure 9 shows an example of the progress graph for a sewage plant outfall. UVAS[®] plus permits ultra-fine differentiation in the range of approx. 20–30 mg/l COD .

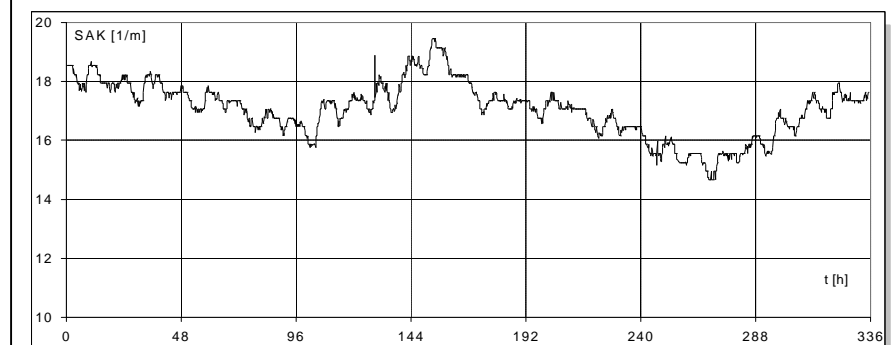


Figure 9: Progress graph of SAC over time at the outlet of a sewage plant



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Überall in Europa vertreten

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SAC as totalising parameter

Measuring principle

The UVAS[®] plus process probe has a flashlight photometer with a cuvette formed by a gap (aperture) in the probe housing. The UV extinction of the immersion medium around the probe is measured across the width of this measuring aperture. A wiper in the aperture prevents fouling of the measuring window. The effect of turbidity on UV absorption is compensated by a reference measurement.

Totalising parameters

The parameters COD, BOD, TOC and SAC are all "totalising" parameters that measure an entirely specific, although not fully identical aspect of water pollution. 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 2).

The user must therefore decide which totalising 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 and open-loop control of the sewage 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	

Figure 2: Typical totalising parameters

Comparison between SAC and TOC/COD

Numerous scientific studies have proved the comparability between SAC and COD or TOC. Baumann and Krauth obtain a correlation factor of 0.94 or 0.98 between COD and TOC in measurements in the primary settling tank /1/. Matsché and Stumwöhrer also show that "UV-absorption has an excellent correlation to COD in wastewater treatment plants" /2/.

Figures 3 and 4 show example progress graphs for COD or TOC together with the SAC progress line, for the inflow to a local authority sewage 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 3 indicates a high solids concentration, which had to be detected by an additional solids measurement.

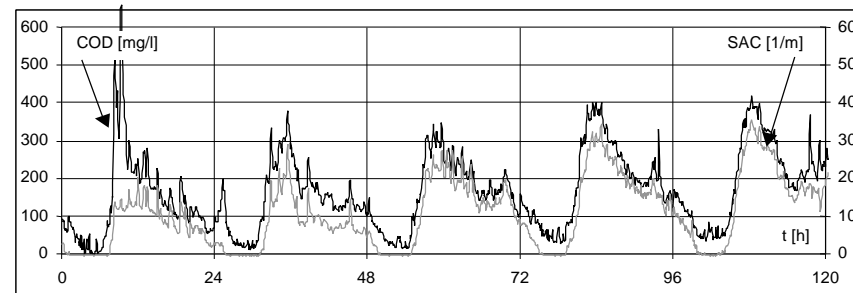


Figure 3: Comparison of SAC and COD progress lines for a local authority sewage works

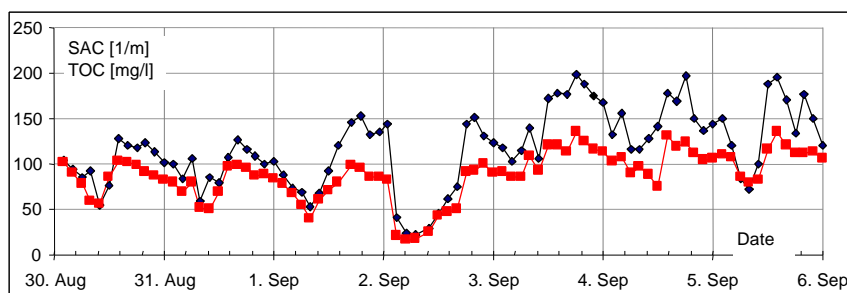


Figure 4: Comparison of SAC and TOC progress lines

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Application in city drain network

Optimisation of outflow processes in the drains

The UVAS[®] plus process probe permits direct measurement of the organic pollutant content of wastewater in a drain network, thereby establishing the basic conditions for:

- Quantification of pollutants discharged into the sewage system by the drainage network,
- Load-dependent managing of rain basins
- Use of accumulation capacity in the drain network to even out peaks and troughs in pollutant inflow,
- Monitoring of indirect inlet lines.

Measurement of wastewater pollution in the drains

Figure 6 shows the continuously measured organic pollution of wastewater at a spillway in a drain network over a period of 4 days. Measurements were taken with the UVAS[®] plus UV process probe. In addition, as a measure of the volumetric flow, the height of overflow above the spillway is shown.

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

Due to a rain incident, on the 8th of October at about midday, after a long period of dry weather, there was 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 sewage plant outfall (SAK ~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 expedient not to channel highly diluted mixed water through the sewage plant but to discharge it directly.

Bibliographical reference:
 /1/ Baumann, P., Krauth, K.: Vergleichende Untersuchung zur Bestimmung der organischen Belastung im Abwasser (Comparative study to determine the organic pollution of wastewater); Report by the Institute for Residential Waterworks, Water Quality and the Waste Industry, Stuttgart University (1994)
 /2/ Matsché, N., Stumwöhrer, K.: CSB-Bestimmung durch UV-Absorption (Determination of COD by UV absorption) Special I 137 (1996), pages 25-31



Figure 5: UV process and turbidity probe

Figure 5 shows a measurement arrangement for this type of application, in this case at a rain overflow basin. In order to measure undissolved contaminants, the SOLITAX[®] solids probe is also used here.

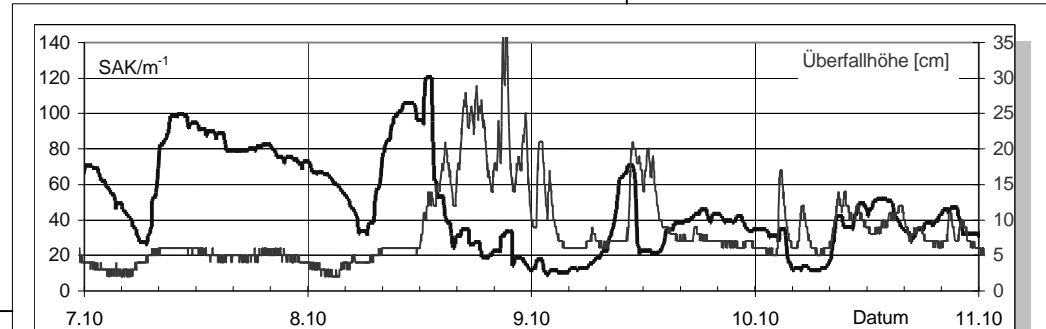


Figure 6: Variation of wastewater pollution and wastewater flow in rainy weather