

## Application of the ISA Spectrometer in a wastewater treatment plant

Emission Limits relating to waste water are becoming increasingly important at the international level. For this reason, the determination of the concentration and composition of waste water is advantageous especially for treatment plant operators.

Therefore concentrations of certain substances in waste water treatments should be observed continuously. And another important point is, that the observed concentrations are available in real time. So it is possible to notice for example changes in concentrations and to react at once. The ISA Spectrometer is ideally suited for such a monitoring in different positions of a treatment plant. The ISA Spectrometer utilizes the UV/VIS range to determine various parameters in the wastewater simultaneously. Thus, a determination of, for example **NH<sub>4</sub>**, **NO<sub>3</sub>**, **NO<sub>2</sub>** and **COD** in one measurement is possible.

Possible installation positions are for example in the influent or effluent. But an installation in the sector of activation is also possible. Due to the fact that an immediate in medium measurement takes place in every possible place of installation, thus no ultrafiltration is necessary as is necessary in the application of an analyzer. In addition, sampling or sample preparation is no longer necessary.

## ISA Spectrometer

The ISA, an in situ spectral analyzer, is a spectrometer operating in the wavelength range 200 to 708 nm (UV-VIS). The result of a single measurement is an absorption spectrum over the entire wavelength range.

In contrast to electrochemical sensors and multi-parameter measurements, a spectrometer is a very versatile instrument.

It can be adjusted by calibration in a wide variety of applications. ISA also has an adjustable measuring path length, which increases the number of possible applications additionally. A major advantage of the ISA is the particular coating of the glass sheets in the measurement path and the possibility of the measuring section to get cleaned automatically with compressed air. For this reason the ISA can reach very long service life and service intervals. As shown in the photo besides external contamination is apparent but the measurement gap was not clogged, which is due to the automatic cleaning by compressed air. For this reason, the cleaning takes only a few minutes and the device can be put back into operation after a short time.

In the measuring head of the ISA, which is made of V4A stainless steel, only the optics and the compressed air cleaning system are included. The entire control and evaluation electronics are installed in the associated sensor module or the BlueBox TS.



As a result, the ISA can be used in a high temperature range (up to 110°C). Thus ISA is also suitable for the use in the medical field or the food industry, as the measuring head can be sterilized at high temperatures.

## Application specific calibration

For the calculation and calibration to the desired parameters of a specific application, it is necessary that for each parameter reference values from chemical laboratory analysis and the corresponding spectral values are provided. In case of a **one-parameter calibration** a spectrum is assigned to one reference value, in a **multi-parameter calibration** there is more than one reference value assigned. The spectral data of a spectrum plus one or more corresponding measurement values are called **reference value pair**. The **number of required pairs of reference values pairs is 25**, a smaller number reduces the quality of calibration and consequently leads to erroneous determination of values of the parameters. The software ISA plus computes the **calibration coefficients** out of the reference value pairs. Thereafter these calibration coefficients have to be transmitted to the BlueBox with the AMS software via a connected PC.

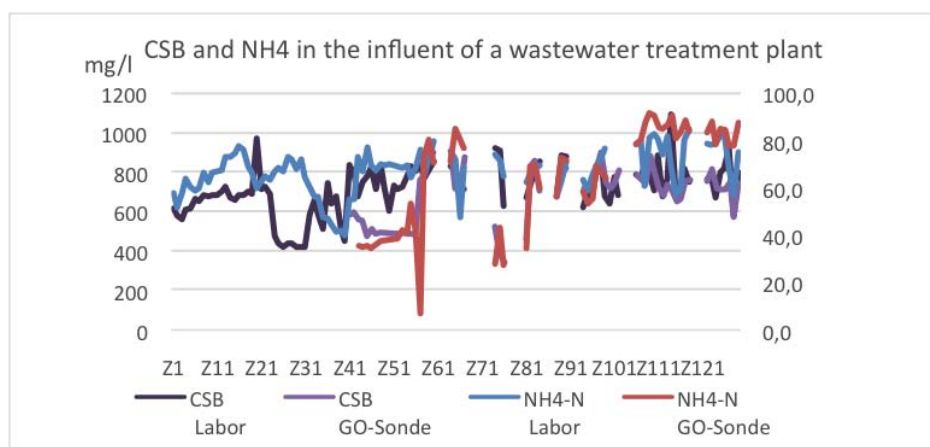
The attainable accuracy can be influenced by external factors (e.g. characteristics of the medium). A guarantee on the quality of the spectroscopic analysis can therefore not be given.

## Results from a municipal wastewater treatment plant

The results of the measurements with the ISA spectrometer can best be compared with present measurements made in a laboratory. As an example the changes in concentration of ammonium (NH<sub>4</sub>) and CSB is shown in the illustration curve below.

91 samples show the concentration of ammonium (NH<sub>4</sub>) and the COD (chemical oxygen demand) in

the influent of a wastewater treatment plant. In The first half the values measured by the ISA and in the laboratory are very different, very large meandering are visible. But from sample Z50 to the last sample (Z91) the values become more similar in both ammonium and COD. The reason for that is, that a good calibration needs as many samples as possible to get correct. Especially NH<sub>4</sub> laboratory tests may be influenced by changes in work



flow of taking sample and proceed the laboratory analytical work, as well by changes of the contribution of the samples as by changes in timing of sample handling and environmental temperature conditions.