The Photometry Dictionary

TIPS AND TRICKS FOR PHOTOMETRIC MEASUREMENTS –
FROM OUR CUSTOMERS' MAGAZINE
WATERWORLD

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The spectral absorption coefficient is generally referred to as SAC (unit: 1/m). It is used to determine the sum of the dissolved organic water content substances by means of laboratory or process photometers. Upon a closer look, you will find that for measurements that differ greatly in their methods, the collective term SAC is used. In practical applications, so-called SAC measurements have been established for two different wavelengths: in water supply, the SAC is usually measured at a wavelength of 436 nm, in the wastewater industry, it is measured at 254 nm. As a limit you must know that this summarizing determination can only be used with reason, if the qualitative composition of the water content substances does not change significantly.

Drinking water should be clear and colorless. Therefore, a color measurement has been established for the qualitative evaluation of water in the water supply industry. Yellow and yellowish brown colorations of drinking water, for example, can be caused by iron and humin. An increased coloration normally does not present a health risk, but should be avoided for aesthetic reasons. Normally, measurements at three different wavelengths, 436 nm, 525 nm and 620 nm, but at least one at 436 nm (SAC_{436}) of a filtered water sample are conducted for the coloration determination.

The basis of the absorption measurement at 254 nm in the wastewater industry is based on the characteristic of diverse, dissolved organic compounds to absorb ultraviolet light. The results are used to create correlations with wastewater-relevant sum parameters, such as COD. Especially with this measurement, generally referred to as SAC_{254}, there must be further methodic differentiation:

Spectral absorption coefficient

The determination of the spectral absorption coefficient takes place as per DIN 38 404-3. In the current DIN standard, the previously used term SAC_{254} has been replaced by $\alpha(254)$. Basically, the spectral absorption coefficient is determined in clear samples, turbid samples must be filtered (filter pore size: 0,45 µm).

Spectral attenuation coefficient

Contrary to the spectral absorption coefficient, turbid samples are measured unfiltered at 254 nm to determine the spectral attenuation coefficient $\mu(\lambda)$. Thus, the light attenuation by light dispersion effects of particular sample content substances is captured as well.

Corrected spectral attenuation coefficient

To determine the corrected spectral attenuation coefficient $\mu(\lambda)_{corr}$ of turbid samples, a measurement will be conducted at 254 nm and 550 nm. The measurement at 550 nm is used as a reference measurement to determine the stray light/turbidity portion by particles. This turbidity portion is subtracted from the absorption measured at 254 nm and represents a turbidity correction. Therefore, $\mu(\lambda)_{corr}$ is nearly equal to SAC_{254}, or $\alpha(254)$.

Laboratory measurements

WTW offers direct methods with their laboratory photometers of the photoLab® series: with photoLab® 6600 for the UV-VIS range, the SAC_{254} of clear samples and the $\mu(\lambda)_{corr}$ of turbid samples can be measured. In addition to this, a color measurement at 436 (SAC_{436}), 525 and 620 nm can be read directly with the photoLab® 7600 with the photoLab® 7100.

In the laboratory, turbid samples can be filtered quite easily and spectral absorption coefficients can be determined; this cannot be done directly in the process with process photometers. Therefore, for in-situ measurements of turbid samples, you do not need to determine the SAC_{254}, but the corrected spectral attenuation coefficient $\mu(\lambda)_{corr}$.

In-situ measurements

With the WTW in-situ spectral probes CarboVis® and NiCaVis®, which cover the entire UV-VIS range, in addition to $\mu(\lambda)$ (SAC_{total}) and $\mu(\lambda)_{corr}$ ($SAC_{dissolved}$), there are very precise COD measurements taken and displayed directly. The information density for measurements across a large wavelength range is much higher compared to a measurement at only 1 or 2 wavelengths. Because of this, the correlations between the dissolved organic contents with sum parameters such as COD are greatly improved. Also, interferences such as turbidity or discoloration of the sample, can be optimally compensated with these spectral probes. Especially with wastewater, which feature changing content substances throughout the year, this more elaborate measuring methods delivers more accurate and reliable measuring values than determinations at only 1–2 wavelengths.