Application Report
DOC (UV Absorption) in Raw Water

The water available at the inflow of a Water Treatment Plant originates from different sources: ground water, rivers, lakes, wells. Accordingly, this water can be contaminated in different ways. Solid particles, dissolved organic carbons, humic acids, germs or micro pollutants can occur in any combination. Numerous dissolved organic carbons absorb ultraviolet light.

Picture: Artificial or natural lakes as sources of water

Whilst the solids can often be seen by the naked eye (turbidity), dissolved organic carbons and other harmful substances can not be seen.

Benefits

The UV absorption is a sum parameter which can be easily determined and which allows a statement on the contamination of the waters with dissolved organic carbons. One often also refers to DOC (Dissolved Organic Carbon).
In each individual plant, the correlation between UV absorption and DOC can be determined and the instrument correspondingly programmed. For this the customer's cooperation and their laboratory is necessary.

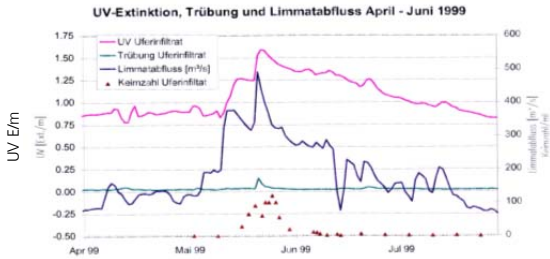
Typical application

Water is fed into the water treatment plant through a channel or a pipe. With a pump or with hydrostatic pressure, a sample is fed to the measuring instrument.
Depending on the origin of the water, the season and the current weather conditions, the water sample will contain more or less solids (turbidity). This can be lower than 1 FNU to several hundred FNU. The sample therefore has to be filtered in most cases. SIGRIST offers such a filter unit in their portfolio, consisting of a coarse filter of 1 µm and a fine filter of 0.5 µm.

In addition to the solid particles, the water can contain dissolved organic carbons, which can not be filtered. This organic load is measured with UV absorption and shown in E/m. Typical values are 0 to a few E/m. Depending on the requirements of the individual countries a respective reaction is necessary. The SIGRIST instrument can measure up to 30 E/m (with the 100 mm PVC cell) and up to 60 E/m (with the 50 mm PVC cell).

Picture: ColorPlus Bypass with 100 mm PVC measuring cell

Practical UV absorption measurement



Picture: Measurements in the runoff of Lake Zurich (Limmat)

In May – June 1999 there was an intensive period of rain, which resulted in the enormously increased mass of water at the runoff of Lake Zurich.
The graph shows the reaction of the UV absorption in E/m (pink, left scale), the amount of runoff water in m³/s (blue, right scale), turbidity (green) and the bacterial count (small triangles).
The UV absorption normally lies here below 1 E/m. With the increasing amount of water, the amount of organic carbon and the bacterial count also increased.
In this application, a limit can be determined at e.g. 1.1 E/m, at which the instrument initiates an alarm if it is exceeded. Thus the instrument indicates that an increased amount of dissolved organic carbon is contained in the water.

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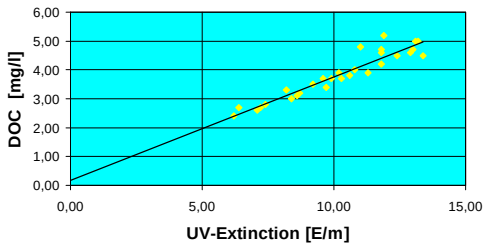
SIGRIST PROCESS-PHOTOMETER

Correlation UV absorption (E/m) – DOC (mg/l)



Picture: Correlation UV absorption - DOC

In each installation, the ColorPlus is first adjusted to E/m. In the course of several days and weeks, measured values of organically loaded water are recorded. For each value, the DOC content (in mg/l) is determined in the laboratory. As soon as the number of values is large enough, a curve can be extrapolated. The ColorPlus is subsequently parameterized (offset and scale factor) and converted to show the results in mg/l DOC.

Cost-benefit analysis

With this measurement, the water treatment company has a cost-advantageous online monitoring system of raw water. If an alarm is given, a laboratory measurement is initialized and, depending on the intensity of the contamination, the water can be channelled into the reject. The online measurement results in process reliability and the number of samples which have to be analysed in the laboratory is reduced to a minimum.

Picture: ColorPlus Bypass in raw water with filtration of sample

Products

SIGRIST product and configuration for this application:

- Water instrument 254 nm/100 mm with access: ColorPlus 2
- SICON control unit
- Optional: filter unit FEW4 with filter cartridges
- Alternative: individual configuration, Basic instrument 1 UV bypass: ColorPlus 2, measuring cell, light source(s)

Parameter settings

- Adjust water flow
- Determine limits for pre-alarm and alarm with the customer

Advantages of SIGRIST ColorPlus bypass » Customer benefits

- Internal compensation of window soiling
  » permanently precise measuring values
- Little maintenance effort: The instrument causes an alarm as soon as the measuring cell needs to be cleaned
  » no fixed maintenance cycle is necessary
- Simple cleaning of the measuring cell
  » low maintenance cost
- Control of device exclusively with distilled water and checking unit
  » no chemicals are necessary
- Very high sensitivity
  » low detection limits
- Influence of turbidity can be compensated with a 2nd wavelength of 700nm (alternative to filtration but ONLY in case of very low turbidity)
  » values measured are more precise
- Optionally, the measurement of colour in Hazen (also called Pt-Co) can be integrated at low costs
  » one instrument – two measurements