Analytical Quality Assurance Made Easy

Automatic turbidity control

The waste water plant Bergen on the island Rügen (north-east Germany) is a member of the island's water supply and waste water treatment association (ZWAR), which was founded in june 1992. The association is responsible for 41 communities on the islands Rügen, Ummanz and Hiddensee with a total of 182500 inhabitants.

> *"Despite careful working procedures and constant quality control, turbidity is often underestimated as a source of error in photometric water analysis."*

According to the self-monitoring directive of the province of Mecklenburg-Vorpommern (SÜVO-M-V), the waster water plant Bergen, which is connected to multiple discharge areas, regularly conducts photometric measurements since 1986. To safeguard results, we adhere to and document all quality control measures as defined in the quality control card DWA-A-704 (German federal directive concerning quality control for photometric measurements used for self-monitoring on waste water plants).

Despite careful working procedures and constant quality control, turbidity is often underestimated as a source of error in photometric water analysis. Since finely dispersed turbidity is hardly noticeable with the human eye, it can lead to significant deviations in measuring values up to 30 %. Therefore, to increase result safety for users, MACHEREY-NAGEL has integrated an automated turbidity control function (NTU-Check) for tube tests into their spectrophotometers.

This turbidity control is based on a 90° stray light measurement at 860 nm, which is the same principal as in commercially available turbidity meters. Parallel to every tube test measurement, the photometer performs a turbidity measurement, displaying the result directly in NTU (nephelometric turbidity unit, international turbidity unit). No additional operation or working steps are required. The automatic turbidity control can be activated or deactivated simply within the menu. NTU values

Pic. 2: Quality assurance in the self-monitoring process

Pic. 1: Waste water plant Bergen

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that exceed a previously set threshold value, are displayed and marked on the screen in red (Pic. 3). Thus, possible impairments of the result are visualised directly.

We have been using the automatic turbidity control for 6 months now and the experience has been entirely positive. For the most samples and tubes, there is no turbidity to be found, neither in the sample or during the analysis. In case of sum parameters (COD, total-P, total-N), any turbidity in the samples is usually dissolved during digestion.

However, the fact that in most cases turbidity does not occur makes the automatic turbidity control especially useful. If every second or third tube was turbid, users would be alerted to the issue. In case turbidity is rare though, it may happen that turbidity is overlooked and wrong results are documented.

During the analysis of COD, the automatic turbidity control provides us with safety, as we can ensure that the mercury sulphate precipitation that forms during the cooling process before the measurement has settled entirely at the bottom of the tube.

When analysing COD, turbidity may also occur if the chloride content of the sample is higher than the absorbing capacity of the respective COD test. Chloride is discharged into waste water due to industrial effluent (in our case especially due to fish processing), chloride containing precipitating agents and in the winter because of de-icing salt. COD tests for controlling the outflow threshold values show falsely low values in the case of turbidity. Conversely, COD tests for high concentrations yield overly high values when turbidity is present. Fine, hardly visible turbidity may already lead to deviations of 10 to 20 %.

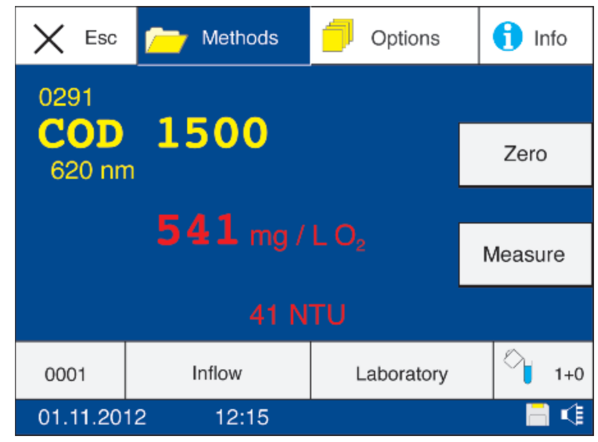
The impact on the results mentioned above were showcased when examining an inflow sample, whose results show the influence of a chloride interference and the resulting turbidity. The COD tube was cooled after digestion to 50° and inverted according to the instructions. After another 10 minutes of cooling, the photometer showed 609 mg/L and a turbidity value of 210 NTU. 20 minutes later, the value decreased to 541 mg/L with the turbidity still being at 41 NTU. The turbidity was not easy to spot and vanished after only 25 minutes. The result was 510 mg/L (Pic. 4).

Using a chloride test strip, we determined a chloride content of 1500 – 2000 mg/L, a value at the edge of absorbing capacity of the test. The following 1 + 1 addition of the sample generated, after digestion, cooling and inverting of the tube, a stable value of 514 mg/L COD.

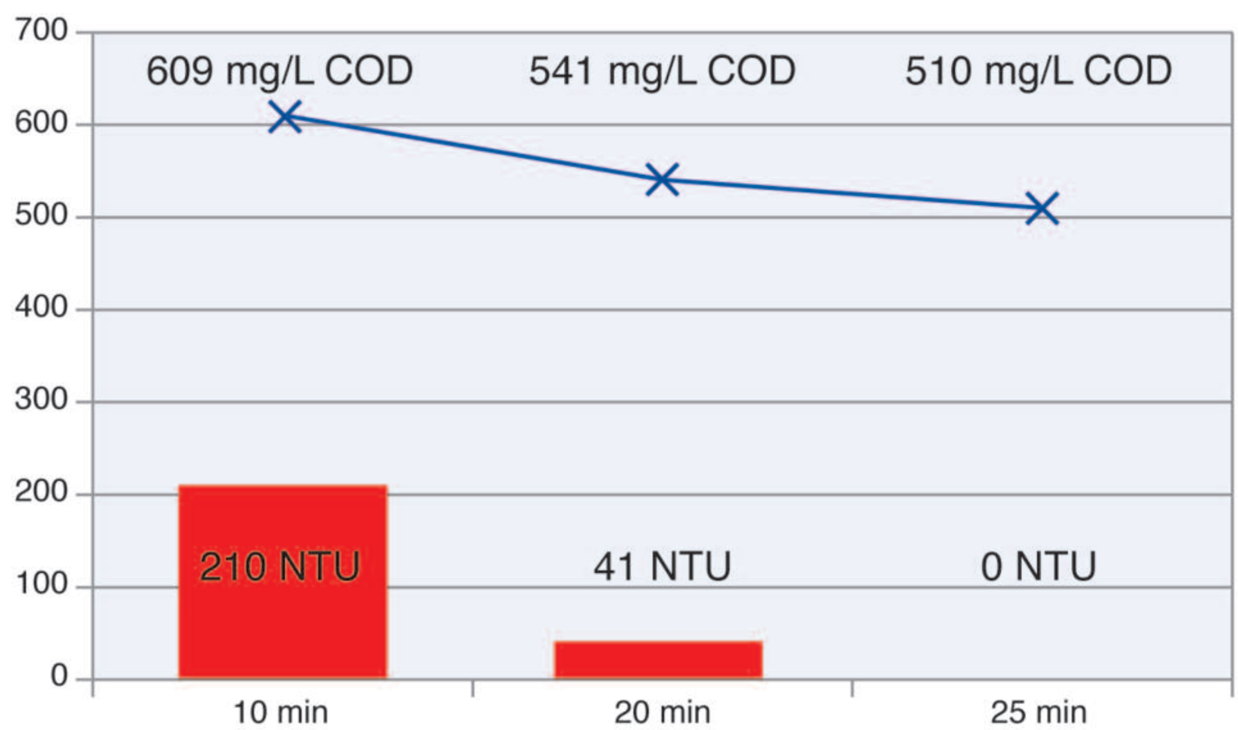
Wrong measurement results stemming from turbidity cannot be compensated for mathematically. Instead, suitable measures have to be taken in order to receive correct results. Such measures include dilution, generating of correction values and filtration.

The results of the automatic turbidity control are saved in the photometer together with the measurement results and can be documented, using MACHEREY-NAGEL software, in addition to analytical quality control procedures, generating additional safety.

After six months of using the automatic turbidity control in our laboratory, we can summarize that it has helped in achieving a higher measurement safety. We are able to eliminate an often underestimated source of error. Thus, results are more reliable without any additional efforts or costs.



Pic. 3: Visual warning in the display



Pic.4: Impact of turbidity on the result

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