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TYPES OF WATER

COOLING WATER / INDUSTRIAL WASTE WATER / WATER EFFLUENT

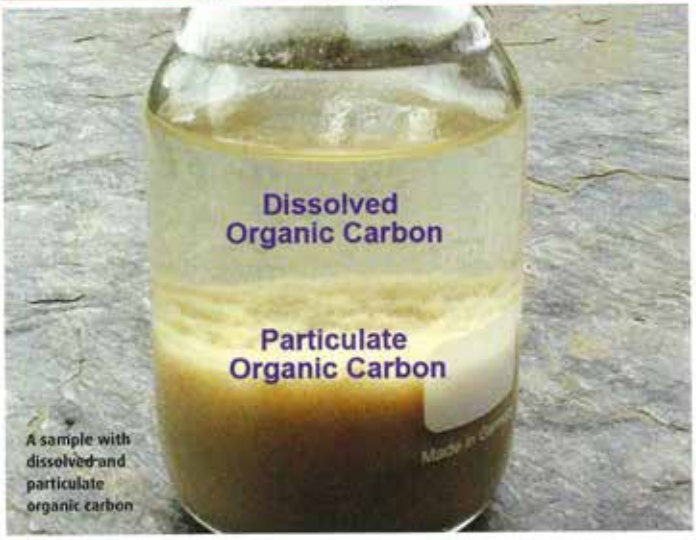
PARAMETERS

TOC / TN_b

How to Profit from TOC Analyzer

Reliable Monitoring of Water Quality

Pictures: LAR



A sample with dissolved and particulate organic carbon

The process oriented construction of a chemical plant is one of the most important aspects to ensure high quality production. Malfunctions may lead to extensive and expensive consequences. To prevent this, the TOC (Total Organic Carbon) content is detected in the immediate proximity of the processes using an online analyser. This article presents two success stories.

MARTIN GLITTENBERG

An international pharma group with locations in Germany and Switzerland, monitors the inlet and outlet of its production sites for organic carbon and nitrogen. The water is characterised by a high salt concentration and frequently changing loads. On high contamination at the waste water treatment plant's inlet, the waste water is led into a reservoir. The monitoring of the outlet is for the documentation of the successful treatment on request of the appropriate local authorities. In order to ensure that the discharge regulations have been observed as well as for the protection of the treatment processes an online analyser is used that measures the total organic carbon in combination with nitrogen. This measuring system monitors two sample streams. The influent stream has a range of 0...1,000 mg/l C, while the effluent stream has a range of 0...100 mg/l C. Normally, the measurement values of the two streams differ by a factor of 70. The expectations of the end user were high: Besides correct measurements, no memory effects or cross contamination of the two streams were allowed. Additionally, a robust design and high availability were requested.

In order to find the best suitable system, several online analysers and methods were tested. One analyser working with the wet chemical oxidation method showed strong dependencies with the sample matrix and was not able to measure the outlet stream stably. Due to the weak oxidation power and its incomplete oxidation, a new correction factor needed to be defined very frequently. This increased maintenance, however, was only performed inadequately by the manufacturer's representative in Germany.

Further measuring systems which worked with continuous and discontinuous catalytic thermal oxidation methods failed as well. The reasons were various. However, mostly due to the fact that the reactor could not handle salt which caused intensive maintenance and low availability.

Finally, after an 8-week-trial, the end user decided to install the LAR analyser that works with the Ultra High Thermal Oxidation at 1200 °C. It is in use since then. This 2-stream-system measures the TOC in combination with TN_b (Total Nitrogen bound). The high thermal oxidation potential makes the use of expensive catalysts unnecessary. The innovative robot-driven injection system handles particles very well while the complete raw sample including any particulates is injected into the reactor. After the combustion, the produced CO_2 is led through the appropriate NDIR detector and the true TOC is detected. Subsequently, the nitrogen content is determined by the use of an electro chemical cell (EC-cell).

The complete digestion of all compounds of the unfiltered sample allows an accurate analysis of the required parameters. In the course of the trial, this method proved to be very reliable considering changes of the sample matrix and providing a long reactor service life. Even with high salt concentrations no problems occurred. The maintenance and service time of this system is convincingly low so that the LAR QuickTOC won the test. Now, this online analyser helps reliably to protect the waste water treatment plant from overloading as well as to observe the local discharge regulations.

Monitoring of Cooling Water and Waste Water with One Analyzer

At an international chemical group located in Western Germany, cooling water and waste water is produced during the production processes. Cooling water may be discharged into the river Rhine provided that the local regulations are respected. If the threshold value is exceeded, the discharge will be prohibited. Additionally, organic solvents may

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PROCESS PLUS

Magazine • PROCESS worldwide will focus on water/wastewater technologies in issue 2-2014.

Digital • Further information about TOC analysis you will find at process-worldwide.com (search for "TOC").

Events • Visit LAR at IFAT (May 5-9, 2014, Munich): Hall A5, Stand 112/210

enter the cooling water during production processes. These purgeable organic carbons are a real challenge for analyses.

The waste water is characterised by a high salt concentration of 100 g/l. By now, the company used in both applications two TOC online analysers that worked with the catalytical high temperature method at 680 °C. Despite the use of an dilution unit, the analysers could not reach a higher reactor service time than seven days. Additionally, these installed analysers work with the NPOC or direct method and determine the parameter only insufficiently. In the first step of this method, the total inorganic carbon (TIC) is stripped out by adding acid. However, during this process also the volatile and purgeable organic carbons are removed resulting in the so called non purgeable organic carbon (NPOC). However, this NPOC is claimed to be the TOC. As this method did not correspond to the operators' requirements, different methods were tested in order to find a better solution.

The trial started in spring 2008. Among the tested analysers there was one with the wet chemical method and one with the non-catalytical Ultra High Temperature combustion at 1200 °C. The wet chemical device, nevertheless, proved itself as inappropriate due to its low recovery rates of several substances and its strong dependency on the sample composition. Furthermore, neither the wet chemical method nor the installed catalytical combustion were able to determine both water qualities without any cross contamination.

In contrast to laboratory methods, these analysers work automatically and detect quickly so that in the case of an alarm, any counter measures or trouble shootings are possible almost immediately.

The non-catalytical TOC analyzer, however, convinced through its innovative oxidation method, its robust design as well as the long service time of its reactor. This system determines the TOC by difference, whereby in the first step, the inorganic and organic carbon compounds are completely and verifiably combusted. The CO_2 produced is detected by an infrared detector (NDIR). This first step results in the value of the total carbon (TC). Afterwards, a separate determination of the TIC takes place. The TC less TIC results in TOC including the POC and VOC.

Two in One Measuring without Cross Contamination

In summer 2010 both analyzers have been replaced by one Quick TOC. The TOC analyzer, now quickly determines any exceeding of threshold values ensuring counter measures in time. With the two-stream feature the analyzer measures both waters, the cooling water as well as waste water, without any cross contamination. Using only one device the operators saved not only high costs of investment, but also costs for operating and maintenance. Additionally, by the use of the new technique the availability of measurements was significantly increased.

The analyzers' block-building system provides optimal adaptation to different applications. Various requirements are solved easily with specific features such as the combination with the TN_b measurement or the multi-stream option. Since their installations, these online analyzers optimally control the processes. High maintenance costs due to technical shortcomings or analytical inaccuracy and operational costs due to the purchase of expensive catalysts or chemicals are saved. ●