

Environmental protection

Continuous monitoring of wastewater of Shimadzu p using TOCN-4100



AA-6300 with GFA-EX7i, ASC-6100
and ASK-6100

The quality management tool ISO 9001 has been a standard in many organisations for some years. The significance of environmental management is, however, developing at a much slower pace, although the international standard ISO 14001, defining the requirements for an environmental management system, has existed since September 1996. According to ISO 14001 companies are required to comply with the following:

1. Introduction of an effective environmental management system, in order to achieve the environmental objectives defined by the organisation.
2. Commitment of the organisation to prevent pollution of the environment, which originates from activities, products and services, and to continuously improve their environmental management systems and their environmental performance.

As a manufacturer of laboratory systems, measuring instruments and medical technology systems, Shimadzu also complies with ISO 14001. Shortly after publication

of the standard, Shimadzu initiated the achieving of ISO 14001 at their production plant in Kyoto, Japan. Already in 1997, the first Shimadzu plants were ISO 14001 certified and others followed in 1999 and 2000. An example of the conversion to ISO 14001 at a wastewater treatment facility of a metal coatings plant is described below.

In a metal coatings plant, heavy metals, organic carbon and nitrogen compounds that are produced during the galvanic process contaminate the plant's wastewater. Before these contaminants can reach the public sewer system, the effluent must be treated in a wastewater treatment plant in order to decrease pollution levels.

Until recently the treatment plant was tested twice daily via sampling and laboratory analysis. This procedure caused a temporary hold-up, leading to delayed detection of problems and therefore appropriate measures – collection of the highly contaminated wastewater – could only be initiated after considerable delay. The installation of a water monitoring system, consisting of a TOCN-4100 and an AA-6300 atomic absorption spec-

trophotometer, greatly improved the situation.

TOCN-4100 – organic carbon- and nitrogen contamination determination in only 4 minutes

The compact TOCN-4100 analyser is a single instrument for the determination of TOC (total organic carbon) and TN (total nitrogen). TOC analysis is carried out via catalytic combustion and IR detection and TN analysis via the combustion/chemiluminescence method. Results for both analyses can be obtained within 4 minutes.

The flow line switcher selects a sample stream for TOC and TN determination and directs it to the homogeniser. A rotating blade homogenises the sample before analysis. All components used for sample preparation are subsequently rinsed in order to decrease the likelihood of downtime and need for system maintenance. The TOCN-4100 can be started up and calibrated from a specific control station. It is also possible to select the various sample streams from that station. Numerous alarm and status signals enable easy detection when limiting values are exceeded or system maintenance is required. An automatic dilution function and self-testing of the calibration procedure allows a largely unattended operation of the instrument.

AA-6300 – continuous monitoring of copper, lead and nickel

For the quantitative determination of heavy metal concentrations,

within our own hands

roduction sites 0 and AA-6300

an AA-6300 atomic absorption spectrometer with a GFA-EX7i graphite furnace was used. This system configuration allows the reliable analysis of very low concentrations into the ultra-trace range. Digital control and intelligent system controls enable fully automatic multi-element analysis. All settings and element-specific optimisation of system parameters are carried out easily and securely. The use of modern background compensation techniques guarantees the reliability of the analytical results for complex matrices and spectral interferences. Only when these requirements are fulfilled the routine online monitoring of wastewater is possible.

The AA-6300 with double beam optics and double detector technique is designed for excellent long-term stability and can be used together with the high sensitivity GFA-EX7i graphite furnace. The graphite furnace itself, a closed system, meets a further important prerequisite of online analysis: up to 2000 atomisations can be carried out with a single graphite tube.

During fully automatic online operation, calibration for the elements copper, lead and nickel are carried out from stock solutions in

the desired concentration ranges using the ASC-6100 autosampler and ASK-6100 dilution station. A special online version of the autosampler enables sampling from an external flow-cell. Programming of the analysis sequence is carried out using the WizAArd system software version 3, in which all parameters for the timely sequence of sampling as well as the corresponding waiting times and functions for recalibration and quality control are pre-programmed. Automatic data storage after each single measurement and export functions from the system computer to the network or database are also integrated in the standard version.

Experimental results are obtained from multi-element standard solutions and diluted measuring solutions from certified reference materials. Instrumental parameters are shown in Table 1.

The in- and outflow of the internal wastewater treatment plant can now be tested using both instruments. This offers two distinctive advantages:

1. Fluctuations in the composition of galvanic wastewater are registered. This way the parameters of a wastewater treatment plant

and the employment of additives can be optimised in order to reach a cost-effective full capacity of the plant.

2. Exceeding limiting values in the effluent are registered and the wastewater is immediately collected in a special container. This contaminated wastewater is then redirected to the treatment plant. This way it is ensured that the wastewater which is led to the public sewer system complies with the legal requirements.

The TOCN-4100 and the AA-6300 combine flexibility, performance and sensitivity. Another aspect, however, is also of great importance: continuous monitoring assures that current data is always available and that if irregularities occur, appropriate action can be taken immediately.



TOCN-4100 – simultaneous analysis of TOC and TN in only 4 minutes

Element	Cu	Ni	Pb
Wavelength [nm]	324.8	232.0	283.3
Slit width [nm]	0.7	0.2	0.7
Atomisation	GFA-EX7i	GFA-EX7i	GFA-EX7i
Lamp current D2 BGC [mA]	6	12	10
Ashing temperature [°C]	500	800	800
Atomisation temperature [°C]	2300	2500	2400
Modifier	no	no	Pd
Graphite tube	Pyro	Pyro	Pyro

Table 1: Instrumental parameters for the determination of copper, lead and nickel