SHIMADZU
Excellence in Science

Application News

No. 064

Total Organic Carbon Analysis

TOC and TN Measurements of Wastewater

TOC (total organic carbon) measurement can be performed in a shorter time with a good repeatability compared to BOD (biochemical oxygen demand) and COD (chemical oxygen demand) measurements, and is used as an index for organic pollutants which indicate the degree of water pollution. Since a TOC analyzer directly measures the amount of carbon comprising organic substances, it is less likely to be influenced by sample matrices. Consequently, this is used in a variety of fields, from control of raw factory wastewater containing salts, control of treated wastewater and effluent water, and to the monitoring of the organic matter content in drinking water, environmental water, purified water, etc. In particular, since factory wastewater and influent water which flows into effluent treatment facilities contain high amounts of organic contaminants, TOC control is necessary to optimize the running condition of such facilities.

TN (total nitrogen) is also important as a substance that causes eutrophication, and stipulation of its drainage criterion indicates that it is regarded as a point of importance for wastewater control to prevent environmental pollution. Sewage contains a high content of ammonium nitrogen, and wastewater of a factory which uses nitrogen compounds for materials or additives still contains nitrogen compounds even after treatment. Therefore, the TN concentration in effluents must be controlled to reduce environmental burdens.

Shimadzu TOC-L total organic carbon analyzer can be used for simultaneous measurement of TOC and TN by installing the TNM-L total nitrogen unit. When measuring nitrogen content using the Kjeldahl method, multiple reagents such as acids and alkalis are required and the measurement takes several hours for digestion and distillation.
The TNM-L, on the other hand, uses the thermal decomposition - chemiluminescence method which is no need for reagents and measurement results can be obtained rapidly since each measurement takes only approx. five minutes.

Furthermore, the TOC-L has an automatic dilution function to dilute raw wastewater samples before measurement; the function contributes to reducing the frequency of replacements of consumables, such as the catalyst and combustion tubes.

This application news introduces an example of simultaneous measurements of the TOC and TN of wastewater from a metal plating factory and its treated wastewater, using Shimadzu TOC-L_{CPH} total organic carbon analyzer and TNM-L total nitrogen unit.

M. Tanaka

Analysis Method

The TOC and TN values of wastewater from a metal plating factory and the effluent from treating the wastewater by the precipitation method were measured simultaneously. In a metal plating factory, chemicals and additives containing nitrogen compounds may be used so both TOC and TN values must be controlled.

The calibration curve for TOC measurement was created from 0 and 5 mgC/L aqueous solutions of potassium hydrogen phthalate. Also, the calibration curve for TN measurement was created from 0 and 30 mgN/L aqueous solutions of potassium nitrate. Both calibration curves were corrected by shifting them to pass through the origin to eliminate the influence of the carbon or nitrogen content in the pure water used for standard sample preparation (Fig. 1).

Table 1 Measurement Conditions

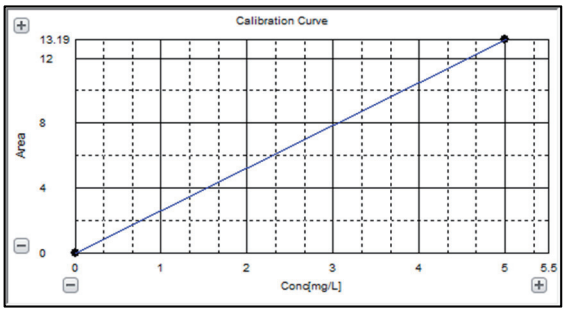
Analyzer	: TOC-L_{CPH} + TNM-L total nitrogen unit	
Catalyst	: TOC/TN catalyst	
Measurement item	: Simultaneous measurement of TOC (= TOC using acidification and sparging) and TN	
Calibration curves	: TOC :	Two-point calibration curve using 0 and 5 mgC/L aqueous solutions of potassium hydrogen phthalate
	TN :	Two-point calibration curve using 0 and 30 mgN/L aqueous solutions of potassium nitrate
Sample	: ① Wastewater from a metal plating factory ② Wastewater ① treated by the precipitation method	

Measurement Result

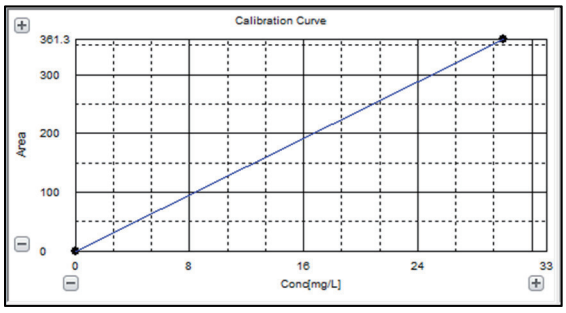
TOC and TN measurement results of sample ①: wastewater and sample ②: treated wastewater are shown in Table 3, and their measurement data are shown in Fig. 1. We can see that the TOC and TN of both samples are measured with accuracy.

Table 2 Measurement Result

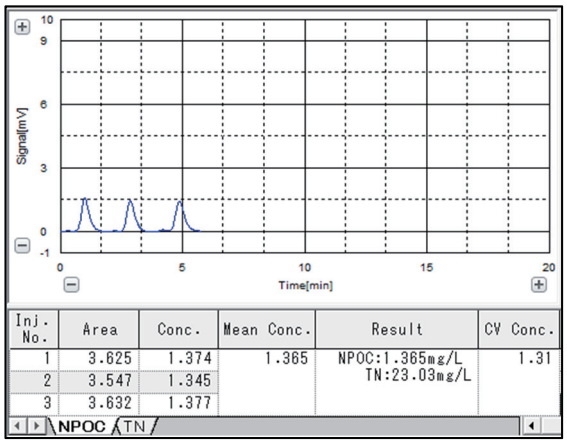
Sample	TOC value (mgC/L)	TN value (mgN/L)
① Wastewater	1.365	23.03
② Treated wastewater	0.9746	5.120



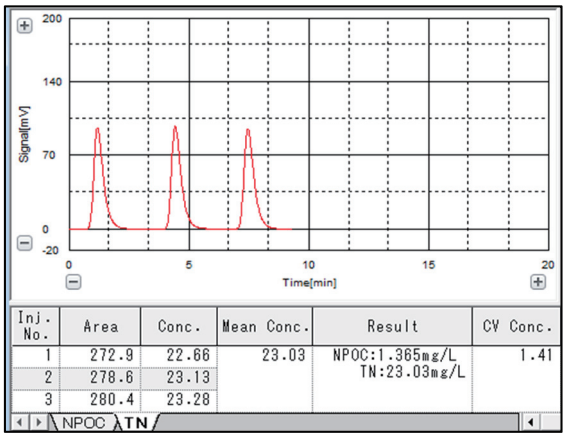
TOC calibration curve



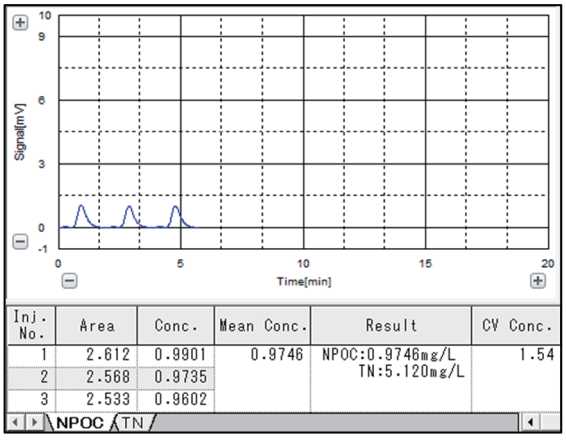
TN calibration curve



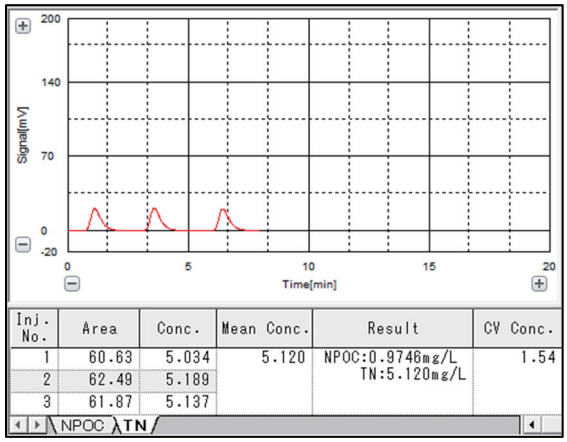
Sample ① Wastewater: TOC measurement



Sample ① Wastewater: TN measurement



Sample ② Treated wastewater: TOC measurement



Sample ② Treated wastewater: TN measurement

Fig. 1 Measurement Data

First Edition: Nov. 2017

Shimadzu Corporation
www.shimadzu.com/an/

For Research Use Only. Not for use in diagnostic procedure.
This publication may contain references to products that are not available in your country. Please contact us to check the availability of these products in your country.

The content of this publication shall not be reproduced, altered or sold for any commercial purpose without the written approval of Shimadzu. Shimadzu disclaims any proprietary interest in trademarks and trade names used in this publication other than its own. See http://www.shimadzu.com/about/trademarks/index.html for details.

The information contained herein is provided to you "as is" without warranty of any kind including without limitation warranties as to its accuracy or completeness. Shimadzu does not assume any responsibility or liability for any damage, whether direct or indirect, relating to the use of this publication. This publication is based upon the information available to Shimadzu on or before the date of publication, and subject to change without notice.

© Shimadzu Corporation, 2017