These articles were selected by Shimadzu for this issue. The articles are from application notes and technical reports relating to environmental analysis and feature a variety of instruments we produce. The cutting-edge technologies are also included. Please obtain the articles of your interest through the links on the titles.

**Selection 1 New Technology**

**On-line LC-GxCxGC-MS/MS: A Powerful Unified Separation-science Tool**

This Technical Report demonstrates the potential of the on-line combination of HPLC, cryogenically modulated comprehensive GCxGC, and MS/MS. The selectivity of the HPLC dimension enabled the separation of chemical classes; each fraction, transferred to the GCxGC instrument via a syringe-based interface, was subjected to a specific programmed temperature vaporizer (PTV) GCxGC-MS/MS for untargeted or targeted analysis.

**Selection 2 Environmental Analysis**

**High-Sensitivity Analysis of Nonylphenol in River Water Using GC-MS/MS**

Nonylphenol (NP) is used as a raw material for the production of surfactants, and as an antioxidant used to protect rubber and plastics, etc. However, in recent years, it has been specified as a substance that can cause endocrine disruption in the environment. We investigated the use of a high m/z selectivity GC-MS/MS for analyzing NP. By optimizing the MS/MS analytical conditions, selective detection of thirteen 4-NP isomers was achieved with high sensitivity. Further, in the analysis of NP in river water, which typically contains many contaminants, analysis was possible without adversely affecting identification accuracy, even when omitting the cleanup procedure that may reduce the recovery rate.

**Selection 3 Environmental Analysis**

**Rapid Analysis of 2,4-DNPH-Derivatized Aldehydes and Ketones Using the Prominence-i with a Shim-pack Column**

This application news presented a rapid analysis of 2,4-DNPH-derivatized aldehydes and ketones using the LC-2010 integrated HPLC with a Shim-pack FC-ODS column. As the goal of this study was to obtain a shorter analysis time than the previous method, we investigated the run conditions using the new Prominence-i integrated HPLC with a 2.2 µm particle size Shim-pack XR-ODS column. Presented here are the results of simultaneous analysis of thirteen 2,4-DNPH-derivatized aldehyde and ketone standards run on a conventional 5 µm particle column, and an example of rapid analysis with a 2.2 µm particle column.

**Selection 4 Environmental Analysis**

**Analysis of Anionic Surfactants by Prominence-i and RF-20Axs Fluorescence Detector**

According to the Ministerial Ordinance on Water Quality Standards, an HPLC method using a fluorescence detector has been adopted as the test method for anionic surfactants. Since either the RF-20A or RF-20Axs fluorescence detector can be connected to the new Prominence-i integrated high-performance liquid chromatograph, the combination of integrated operability and high-sensitivity fluorescence detection is possible. This application news presents an example of the analysis of five anionic surfactants using the Prominence-i integrated HPLC with the RF-20Axs high-sensitivity fluorescence detector.

**Selection 5 Environmental Analysis**

**Simultaneous Determination of Polycyclic Aromatic Hydrocarbons Using the Prominence-i Integrated High Performance Liquid Chromatograph**

Many polycyclic aromatic hydrocarbons exhibit fluorescence, and can therefore be detected with high selectivity and high sensitivity using a fluorescence detector. However, of the sixteen polycyclic aromatic hydrocarbons designated as “priority pollutants” by the U.S. Environmental Protection Agency (EPA), acenaphthylene alone does not exhibit fluorescence. The Prominence-i, which incorporates a UV detector, can be connected to the RF-20Axs fluorescence detector, permitting simultaneous analysis of all sixteen polycyclic aromatic hydrocarbons. Here, using two analytical methods, one with the wavelength switching mode and the other using simultaneous measurement at multiple wavelengths, we introduce an example of simultaneous analysis of the 16 PAHs.

**Selection 6 Environmental Analysis**

**High-Sensitivity Analysis of Ammonia, Methylamine, and Trimethylamine in Environmental and Energy Fields**

The dielectric barrier discharge ionization detector (BID) permits detection of nearly all compounds, except for helium and neon, at higher sensitivity than that possible with TCD and FID detectors. Here, we introduce examples of analysis at the ppm level of ammonia and methylamine in water, and of trimethylamine in water by GC-BID.
Selection 7  Environmental Analysis

Analysis of Multiple Elements in Drinking Water by ICPE-9820

Conducting safety inspections for drinking water is the responsibility of each country according to their respective regulations. Typically, there are many target elements included in the test, such as N, Ca, etc., which are present at the mg/L level or greater, and toxic trace elements such as Pb and Cd, which are normally present at the µg/L level or less. Here, using the Shimadzu ICPE-9820 multi-type ICP atomic emission spectrometer and an ultrasonic nebulizer, we conducted analysis of river water, typically the source of tap water.

Selection 8  Environmental Analysis

Analysis of Heavy Metals in Sewage Sludge and Sewage by ICPE-9820

In recent years, the increase of sewage sludge generated in the sewage treatment process has become a problem. For the purposes of waste reduction and recycling, following incineration, sewage sludge is being re-used as cement material, civil engineering material, fertilizer, etc. However, the reuse of sewage sludge, from the standpoints of environmental protection and potential health hazards, requires that its toxic heavy metal content is carefully examined. Here, using the Shimadzu ICPE-9820 multi-type ICP atomic emission spectrometer, we conducted analysis of processed water from a sewage treatment plant, in addition to sewage sludge ash.

Selection 9  Environmental Analysis

Content Analysis of Toxic Elements in Soil by ICPE-9800 Series

Contaminated soil not only leads to contamination of untreated drinking water through permeation into river water and rainwater, it adversely affects health when the soil itself is directly ingested. Therefore, assessment of soil toxicity using a defined method is required. The apparatus used for the analysis is required to accurately measure those elements at trace concentrations equivalent to or lower than the reference values. Here, using the Shimadzu ICPE-9800 series multi-type ICP atomic emission spectrometer, we conducted content analysis of soil.

Selection 10  Environmental Analysis

High-Speed X-Ray Diffraction Analysis of Asbestos (Chrysotile) Using Wide-Range High-Speed Detector

Asbestos is a material that has long been widely used as a building material due to its excellent heat and acid resistance. However, its use has gradually been banned because of widespread recognition of its adverse health effects. Here, we introduce an example of high-speed quantitative analysis of chrysotile, one kind of asbestos, using the new OneSight wide-range high-speed detector.

Selection 11  Environmental Analysis

Quantitative Analysis of Pyrethroids in Soil Using Triple Quadrupole LC-MS/MS

Pyrethroids are insecticides used worldwide for both household and farming applications. Traditionally, pyrethroids are measured by Gas Chromatography with or without mass spectrometry. Here, we present a method using LC-MS/MS to show that LC-MS/MS can measure these compounds traditionally analyzed by GC. This report illustrates a simultaneous analysis of 15 pyrethroids using the Shimadzu LCMS-8050 with ultrafast polarity switching.

Selection 12  Environmental Analysis

High Speed Analysis of Haloacetic Acids in Tap Water Using Triple Quadrupole LC-MS/MS

Haloacetic acids (HAAs), by-products of water disinfection, are formed from naturally-occurring organic and inorganic materials in water that react with the disinfectants chlorine and chloramine. A LC-MS/MS method, which is capable of direct injection of water samples, for measuring HAAs has been developed to replace previously used methods requiring tert-butyl-methyl ether liquid extraction and diazomethane derivatization prior to GC analysis, thus reducing the effort required for sample preparation.

Selection 13  New Technology

Structural Analysis of Glycosphingolipids by LC-IT-TOF-MS

A method for detection and structural characterization of glycosphingolipids (GSLs) based on LC-IT-TOF-MS is introduced and the results of analysis of GSLs containing sialic acid in mouse thymocytes, CD4T and CDT8 cells are described as an example of its application. Even at trace levels and in a mixture, both carbohydrate chain and lipid structures were characterized, and previously unknown information could be obtained. The development of a new analytical tool is in progress and applicable future challenges are discussed.