

Gas Chromatograph Mass Spectrometer

GCMS-TQ8030

UFMS
ULTRA FAST MASS SPECTROMETRY



GCMS-TQ8030

—*Speed Beyond Comparison*

With enhanced sensitivity and selectivity, triple quadrupole GC/MS/MS is the method of choice for a variety of applications, from food safety and environmental monitoring to clinical research and forensics. As the only GC/MS/MS capable of running all triple quad operational modes, without sacrificing sensitivity or accuracy, Shimadzu's GCMS-TQ8030 elevates this method to a new level of performance. The first GC/MS/MS good enough to be called a Shimadzu, the GCMS-TQ8030 is the ultimate platform for your applications.



High Sensitivity and Enhanced Selectivity

PP. 6–7

- Shimadzu's proprietary, high-efficiency ion source offers unmatched sensitivity
- Overdrive lenses reduce neutral noise
- Variety of measurement modes provide enhanced selectivity and method flexibility

High-Speed Performance

PP. 8–9

- UFsweeper® allows 600 MRM transitions per second
- ASSP™ permits high-speed scanning at 20,000 u/sec
- Fast Scan/MRM measurements provide a wealth of qualitative and quantitative information

Ultimate Ease of Use

PP. 10–11

- AART function automatically adjusts compound and MRM retention times
- Easy sTop injection port reduces maintenance downtime
- Front-opening ion source chamber makes maintenance fast and easy



UFGS
ULTRA FAST MASS SPECTROMETRY
Speed Beyond Comparison

GCMS-QP2010 Ultra
GCMS-QP2010 SE

GCMS-TQ8030

LCMS-8030

LCMS-8040

LCMS-8080

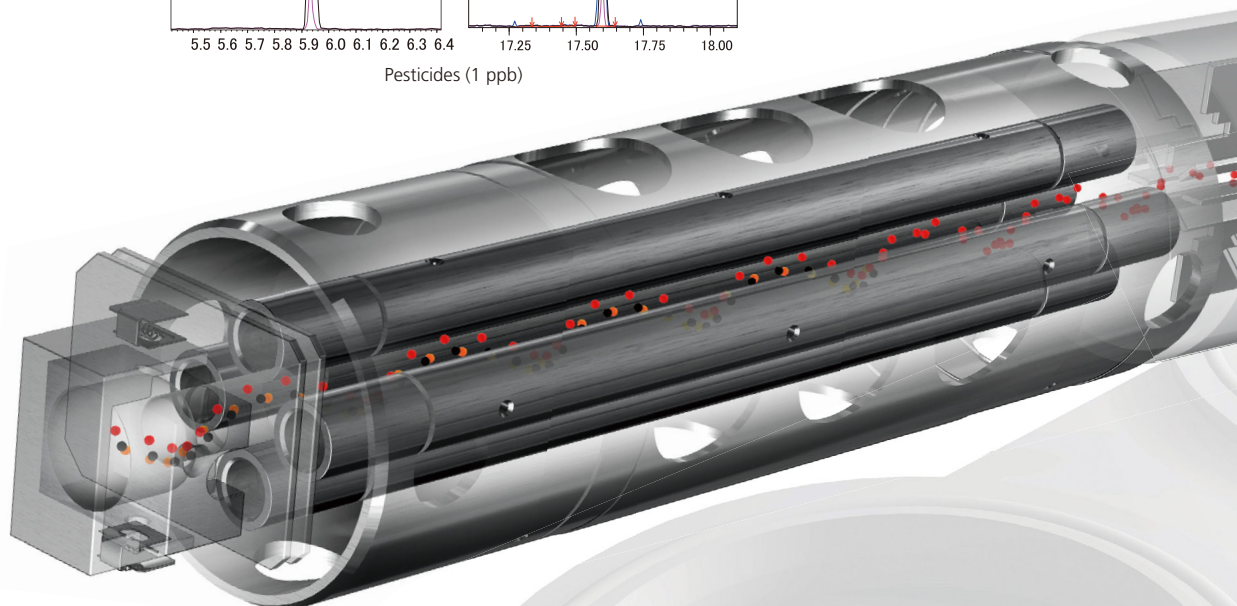
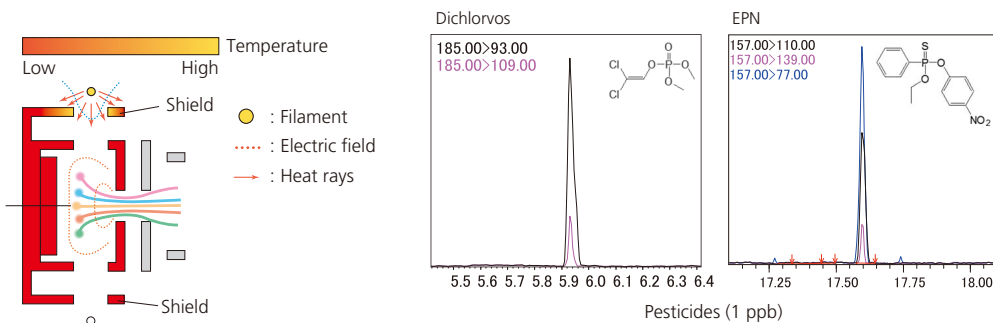
LCMS-2020

LCMS-IT-TOF

High Sensitivity, High Selectivity, and High Speed

High-Sensitivity Ion Source

The effect of the filament's electric potential on the ion source is reduced by placing more distance between the filament and ion source box. In addition, a shield blocks out radiant heat generated from the filament to ensure the ion source box temperature remains uniform. Since this prevents any active spots within the ion source, it provides higher sensitivity for analysis. (Patent: US7939810)

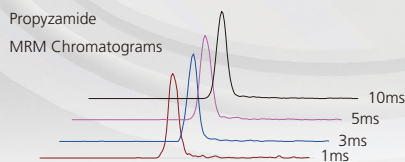
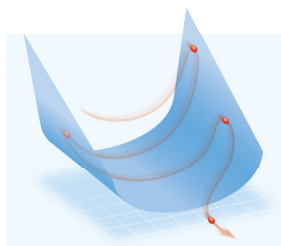


High-Efficiency Collision Cell UFsweeper®

Shimadzu's proprietary UFsweeper® technology achieves high-speed MRM analysis at speeds up to 600 trans/sec. It efficiently sweeps residual ions from the collision cell to provide high-efficiency CID and fast ion transport. Rapid ion removal minimizes cross-talk and enables trace analysis (patent pending).

Enables stable analysis with a minimal drop in sensitivity, even if MRM is set at a high speed. This function is also available in a wide variety of other measurement modes.

UFMS
ULTRA FAST MASS SPECTROMETRY

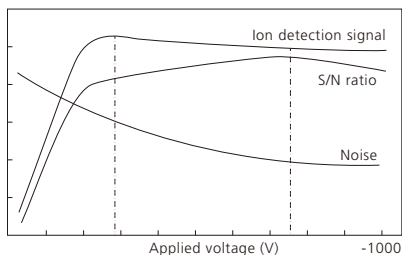


Dwell time (trans/sec)	10ms (91)	5ms (167)	3ms (250)	1ms (500)
%RSD	2.2	5.1	5.0	5.4
IDL (pg)	0.63	1.45	1.40	1.53

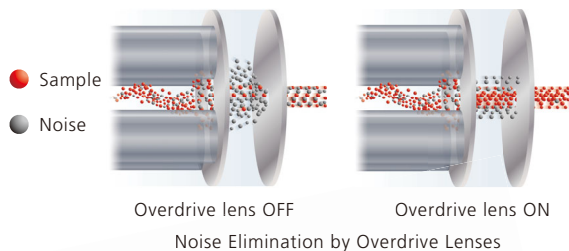
Overdrive Lenses (Noise Elimination Technology)

Two lenses (overdrive lenses) positioned in front of the electron multiplier reduce random noise from helium, high-speed electrons, or other factors, and improve the S/N ratio.

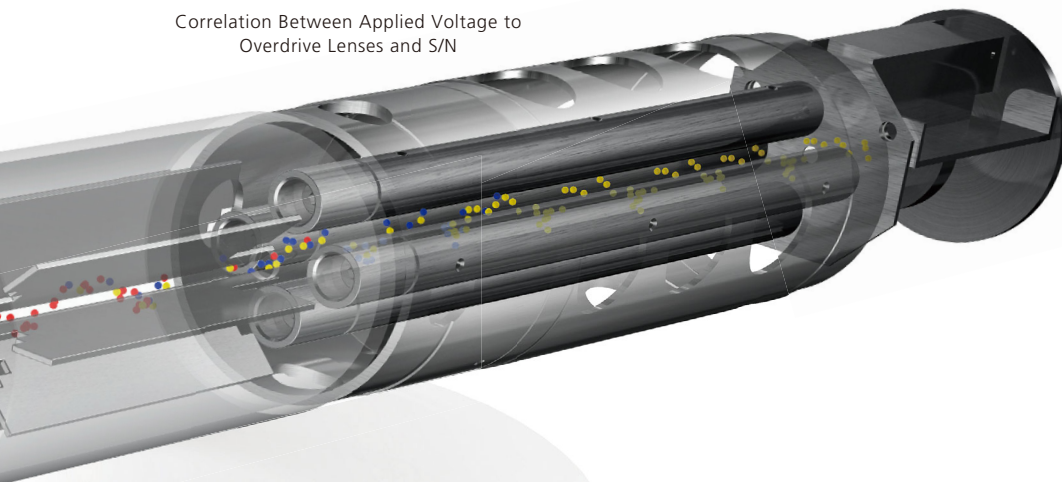
Applying voltage to the lenses improves the S/N level by reducing noise components near the lenses and focusing the ions that pass through the mass filter. (Patent: US6737644)



Correlation Between Applied Voltage to Overdrive Lenses and S/N



Noise Elimination by Overdrive Lenses

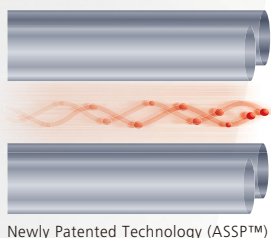


High-Speed Scanning Control (Advanced Scanning Speed Protocol, ASSP™)

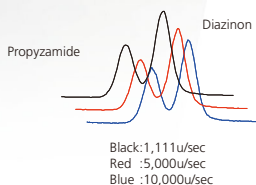


Achieves scan speeds of 20,000 u/sec. The rod bias voltage is dynamically optimized during ultrahigh-speed data acquisition, thereby minimizing the drop in sensitivity that would otherwise occur above 10,000 u/sec. This is necessary for maintaining sensitivity at high scan speeds and acquiring superior mass spectra when performing product ion scans or simultaneous scan and MRM measurement in the scan/MRM mode. (Patent: US6610979)

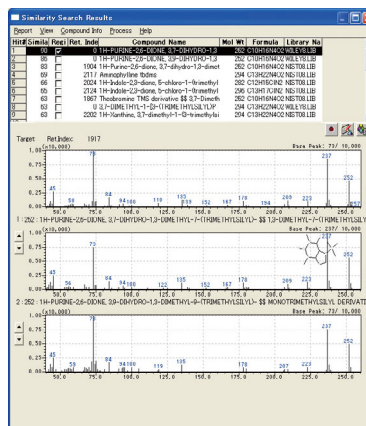
By accelerating ions dynamically during high speed scanning, any drop in sensitivity due to increasing the scan speed is minimized while still obtaining high quality mass spectra.



Newly Patented Technology (ASSP™)



Black: 1,111 u/sec
Red : 5,000 u/sec
Blue : 10,000 u/sec



Similarity search using mass spectra obtained at 10,000 u/sec

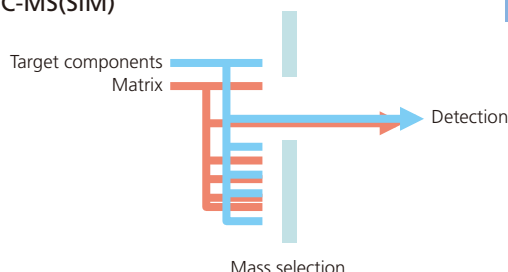
Application Examples of High Sensitivity and High Selectivity

MRM Measurement Using GC/MS/MS

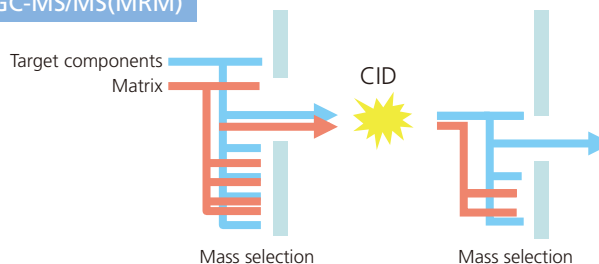
Because GC/MS systems are able to identify individual components using retention time and mass spectra, they are especially useful for detecting trace-level contaminants in a variety of sample types. However, unambiguous identification can be difficult in the presence of a complex or problematic matrix. Multiple Reaction Monitoring (MRM) in GC/MS/MS systems separates

masses in two stages, making this technique significantly more selective than GC/MS. As a result, even components that cannot be analyzed by conventional scan or SIM modes can be easily identified and quantified. For example, MRM can be a particularly effective measurement tool for analyzing residual pesticides in food.

GC-MS(SIM)



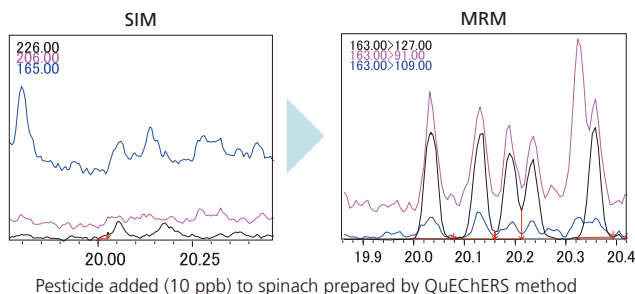
GC-MS/MS(MRM)



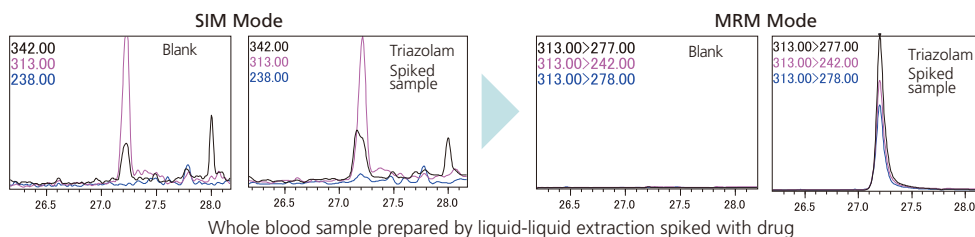
Benefit 1 Significantly reduces matrix effects and detects compounds with high S/N ratios.



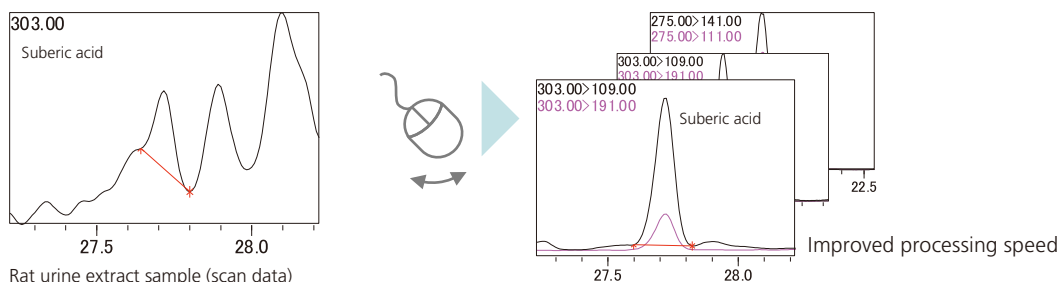
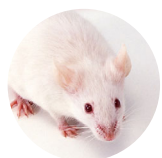
Cyfluthrin-1,2,3,4
10ppb



Benefit 2 Accurately determines presence of target components, even if a complex matrix interferes with the target analytes.



Benefit 3 Stable baseline improves data processing efficiency.



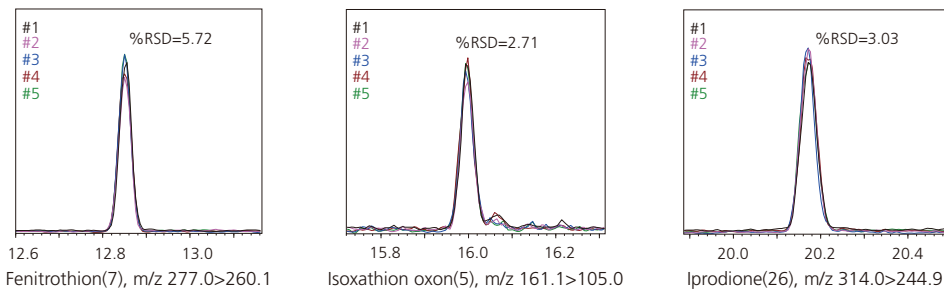
Analysis Accuracy

The lower noise from the MRM mode contributes to improved S/N ratios, and low %RSD. The GCMS-TQ8030 shares the renowned features in Shimadzu's single-quad GC-MS systems for optimizing the

entire system, including the GC injection port and the MS ionization stability.



Repeatability of Analyzing Pesticides (5 µg/L) (chromatograms overlaid for n = 5)



	1	2	3	4	5	%RSD	IDL(pg)
Dichlorvos	3463	3544	3489	3469	3534	1.1%	0.20
Dichlobenil	43614	43797	44314	44554	45023	1.3%	0.24
Etridiazole	8726	9055	8730	8437	8700	2.5%	0.47
Chloroneb	30803	31227	32435	31865	32677	2.5%	0.47
Isoprocarb	49153	49245	50695	49793	51014	1.7%	0.32
Molinate	37898	37838	38956	38973	40007	2.3%	0.43

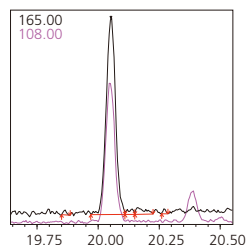
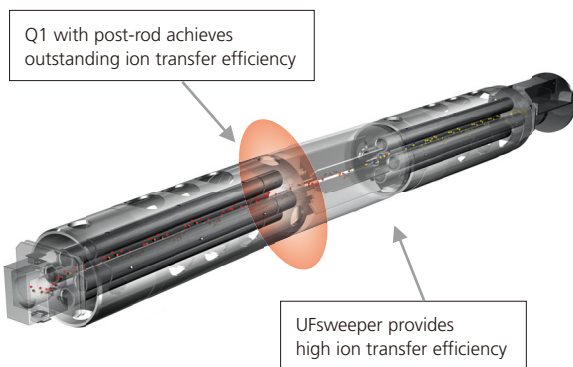
IDL: Calculated by 99 % reliability t-test using area values of five analytical runs of a pesticide mixed solution (5pg/µL each).

*This table shows referential values, not guaranteed values.

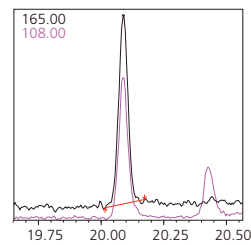
High-Sensitivity Analysis by Single GC/MS Mode

The high-efficiency ion source provides the foundation of an ion generation and transmission system, which efficiently creates, then delivers, ions to the detector, resulting in a GC-MS with the highest sensitivity specification in its class. This achieves high

sensitivity not only for MRM measurements by GC/MS/MS, but also for scan and SIM measurements by GC/MS.



5 ppb pyributicarb
Left: GCMS-QP2010 Ultra (SIM)
Right: GCMS-TQ8030 (Q3 SIM)
Repeatability for n = 5



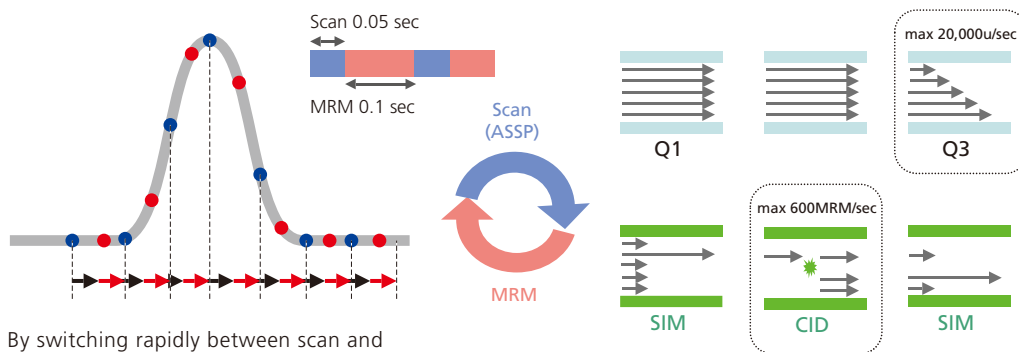
%RSD = 2.80

High-Speed Performance

Scan/MRM Analysis

Scan/MRM is a data acquisition technique that allows the user to collect scan data and MRM data in a single analysis. It is used in the dual role of collecting qualitative scan data, while monitoring MRM transitions for additional confirmation. A high-speed scanning rate of 20,000 u/second allows full spectrum scans within a series of MRM measurements, providing confirmation of target compounds with information-rich product ion spectra.

To qualitatively and quantitatively analyze compounds accurately, a minimum number of measurement points per peak is required. The GCMS-TQ8030 allows 600 MRM transactions per second, even in the scan/MRM mode, ensuring more data points for more accurate qualitative and quantitative analysis.

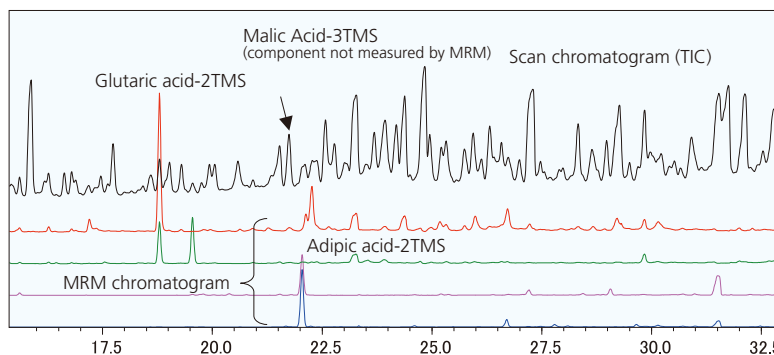


By switching rapidly between scan and MRM modes, data can be acquired using both modes in the same analysis.

Benefit 1 Obtain data on unknown components that cannot be acquired by MRM alone.

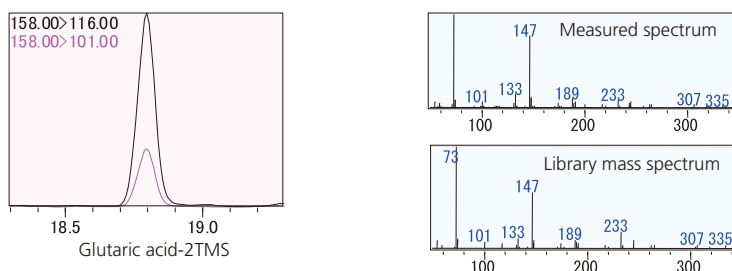
Characteristics of Scan Data

ASSP provides high-quality mass spectra for MS library matching



Characteristics of MRM Data

Detects low-level components without interference from complex matrix

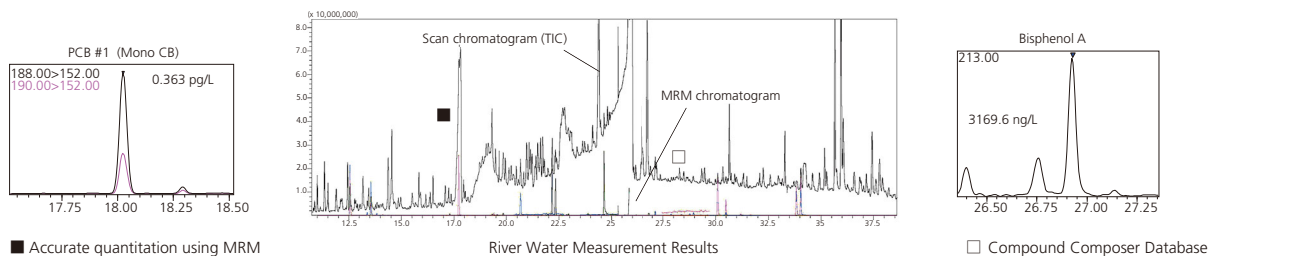


Benefit 2 Use MRM data for trace analysis of target components and scan data for screening of multiple components.

Example of Scan/MRM Measurement of POPs in River Water

MRM: Accurate trace quantitation of POPs

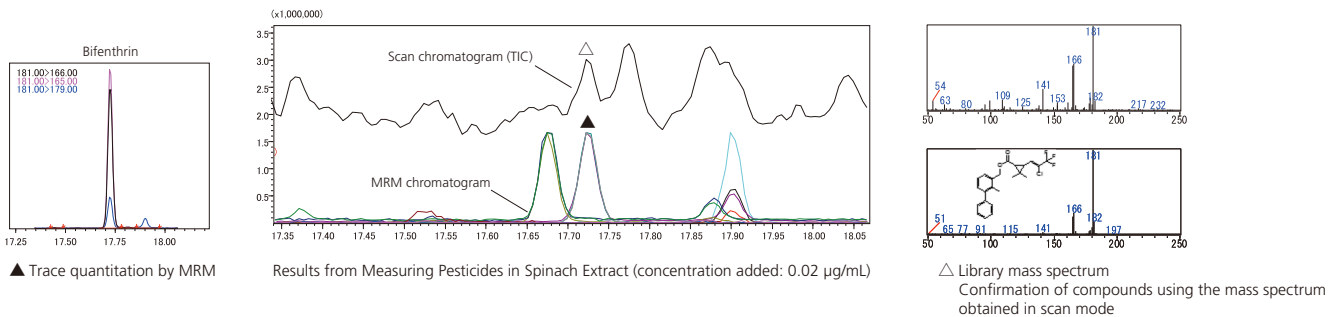
Scan: Screening of 942 hazardous pollutants using Compound Composer Database



Example of Scan/MRM Measurement of Pesticide Residues in Foods

MRM: Trace analysis and accurate quantitation of pesticides

Scan: Qualitative analysis of pesticides

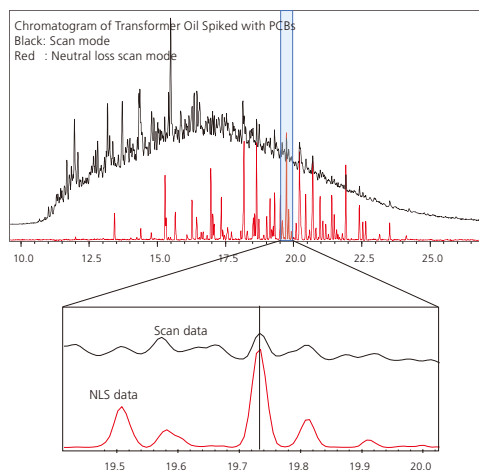


Simultaneous Scan/Neutral Loss Scan (NLS) Analysis

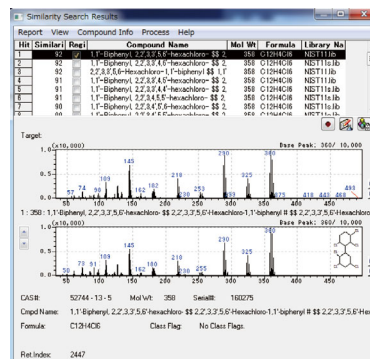
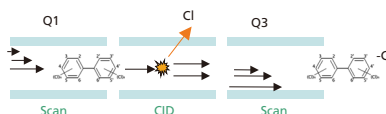
The neutral loss scan (NLS) method selectively detects precursor ions that have a given neutral loss. For example, a neutral loss scan at m/z 35 allows specifically detecting compounds containing chlorine.

Since the GCMS-TQ8030 is capable of simultaneous scan/NLS

analysis, it easily identifies chlorine compounds contained in the sample by using the scan data to confirm the mass spectrum for the retention time in the chromatogram detected by NLS.



Scan and NLS data can be displayed and analyzed on the same screen.



Ultimate Ease of Use

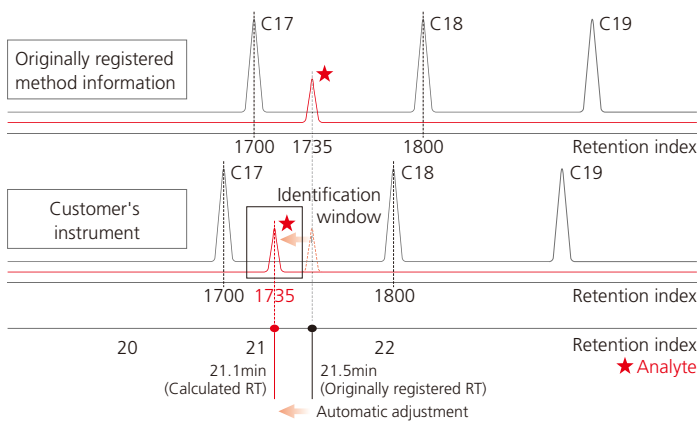
Software Operability

COAST Function – Automatically Prepares Analytical Conditions for MS/MS

MS/MS parameters involve a large amount of information. Therefore, preparing methods for simultaneously analyzing multiple components can become very tedious. Using the GCMSolution COAST (creation of automatic selected ion monitoring table) function enables easy preparation of MRM

methods from compound information managed via spreadsheet software or from MS/MS measurement parameters. It also allows easily reconfiguring previously prepared MRM methods into scan/MRM methods.

Automatic Adjustment of Compound Retention Time (AART) (Automatic Adjustment of Retention Time)



The AART function adjusts the retention times of target components based on linear retention indices (LRI) and the retention times of n-alkanes. The AART function easily adjusts acquisition and processing method parameters simultaneously.

1 n-alkane analysis

2 AART execution

3 Adjustment of retention times

Automatic Adjustment of Retention Time [AART] ??? - (AART).J4m (µm)

The retention time in the compound table of the method file is modified like the following table in addition. If you need to modify the time of the MS measurement parameters by using the difference of the retention time, please run on the following check.

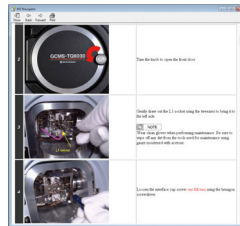
Compound Name	Retention Time (Original)	Retention Time (After)	Ret. Index
1	0.000	0.000	1.00
2	0.000	0.000	1.00
3	0.000	0.000	1.00
4	0.000	0.000	1.00
5	0.000	0.000	1.00
6	0.000	0.000	1.00
7	0.000	0.000	1.00
8	0.000	0.000	1.00
9	0.000	0.000	1.00
10	0.000	0.000	1.00
11	0.000	0.000	1.00
12	0.000	0.000	1.00
13	0.000	0.000	1.00
14	0.000	0.000	1.00
15	0.000	0.000	1.00
16	0.000	0.000	1.00
17	0.000	0.000	1.00
18	0.000	0.000	1.00
19	0.000	0.000	1.00
20	0.000	0.000	1.00
21	0.000	0.000	1.00
22	0.000	0.000	1.00
23	0.000	0.000	1.00
24	0.000	0.000	1.00
25	0.000	0.000	1.00
26	0.000	0.000	1.00
27	0.000	0.000	1.00
28	0.000	0.000	1.00
29	0.000	0.000	1.00
30	0.000	0.000	1.00
31	0.000	0.000	1.00
32	0.000	0.000	1.00
33	0.000	0.000	1.00
34	0.000	0.000	1.00
35	0.000	0.000	1.00
36	0.000	0.000	1.00
37	0.000	0.000	1.00
38	0.000	0.000	1.00
39	0.000	0.000	1.00
40	0.000	0.000	1.00
41	0.000	0.000	1.00
42	0.000	0.000	1.00
43	0.000	0.000	1.00
44	0.000	0.000	1.00
45	0.000	0.000	1.00
46	0.000	0.000	1.00
47	0.000	0.000	1.00
48	0.000	0.000	1.00
49	0.000	0.000	1.00
50	0.000	0.000	1.00

Compound Name	Predicted RT	Measured RT	RT Error
Mono-BDE (BDE-001)	1.561	1.564	-0.003
Mono-BDE (BDE-002)	1.745	1.746	-0.001
Mono-BDE (BDE-003)	1.968	1.960	0.008
Di-BDE (BDE-010)	5.192	5.174	0.018
Di-BDE (BDE-007)	6.292	6.267	0.025
Di-BDE (BDE-008&BDE011)	6.782	6.761	0.021
Di-BDE (BDE-012)	7.098	7.075	0.023
Di-BDE (BDE-013)	7.157	7.132	0.025
Di-BDE (BDE-015)	7.542	7.517	0.025
Tri-BDE (BDE-030)	9.588	9.554	0.034
Tri-BDE (BDE-032)	10.857	10.822	0.035
Tri-BDE (BDE-017)	11.299	11.263	0.036
Tri-BDE (BDE-025)	11.379	11.344	0.035
13C Tri-BDE (BDE-028L)	11.884	11.851	0.033
Tri-BDE (BDE-028&033)	11.884	11.863	0.021
Tri-BDE (BDE-035)	12.270	12.236	0.034

Adjustment covers many points, from low to high boiling points, so accurate adjustment is possible over a wide retention time range.

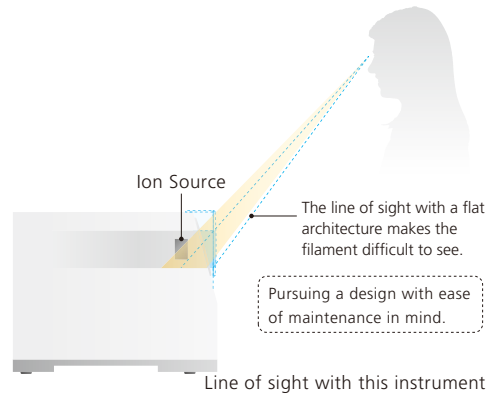
User Friendly

When changing the ionization method or performing maintenance on the ion source, parts inside the evacuation system must be handled. The GCMS-TQ8030 incorporates a front-opening chamber allowing maintenance to be performed with ease from the front of the instrument. "MSNAVIGATOR," which supports maintenance, helps the user perform instrument maintenance.



MSNAVIGATOR Window

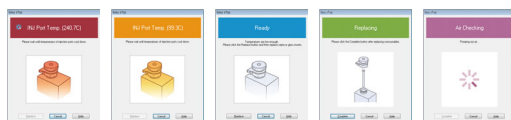
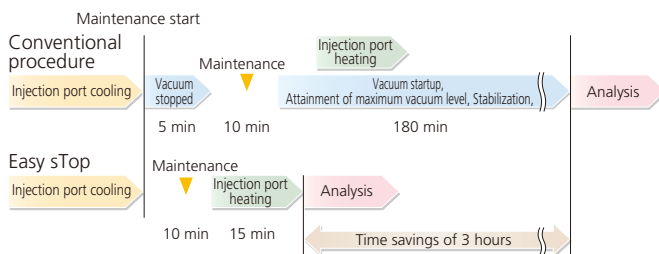
Hardware Operability



Easy sTop for Major Reduction of Maintenance Time

Many applications require that the injection port undergoes maintenance on a frequent basis. With the GCMS-TQ8030,

maintenance is possible without venting the MS so downtime is minimized.



The Easy sTop navigator assists in taking the appropriate steps.

Twin Line MS System Eliminates the Need to Vent the MS

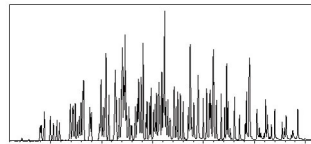
The GCMS-TQ8030 is capable of accepting installation of two narrow-bore capillary columns into the MS simultaneously. This allows you to switch applications without venting the MS.

Simply decide which column is best for your analysis and choose the associated injection port.

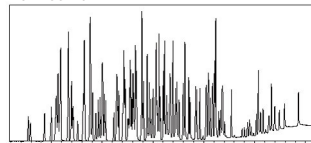
Twin Line MS System



Rxi-5Si1 MS



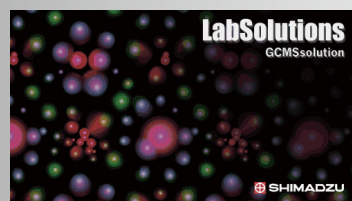
Rtx-200MS



Analysis of pesticide components using complementary column phases

Installing two columns in one MS is possible with the GCMS-TQ8030 because of its high-capacity dual-inlet turbomolecular pump.

* The Twin Line MS System requires an optional installation kit and is limited to certain column dimensions.



Workstation Software Combines Ease of Use and Versatile Functionality

GCMSsolution

GC/MS analysis requires optimizing and managing many GC and MS parameters for data acquisition. Furthermore, analyzing the acquired data requires identifying unknown components included in samples, quantitating more than a few hundred components, and processing them quickly. GCMSsolution software provides a user-friendly interface that allows operating the system intuitively and includes Wizard functions

that assist in entering parameters, ensuring that even first-time users can reliably navigate the system. "One-Window" technology allows the user to customize the window layout for individual methods or personal preference.

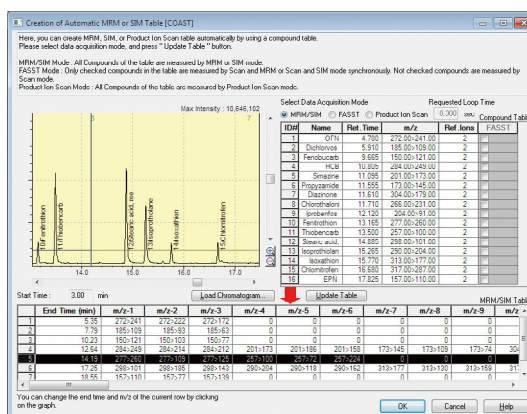
A single GCMSsolution software platform can be used to analyze GCMS-TQ8030 and GCMS-QP2010 series data.

GCMSsolution Real-Time Analysis Program

In addition to scan and SIM modes, the GCMS-TQ8030 offers a variety of other analysis modes, such as MRM and scan/MRM.

The COAST (Creation of Automatic Scan/SIM Table) function enables switching between measurement modes or specifying time programs while checking data.

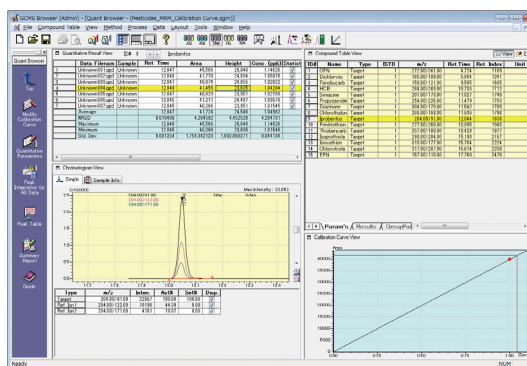
This makes it easy to set optimal analytical conditions that are compatible with a variety of measurement modes.



GCMS Browser Program

Quantitation Browser

The quantitation browser allows the user to review multiple data sets in the same window. This allows checking the chromatograms and quantitation results from multiple samples with minimal switching between windows.

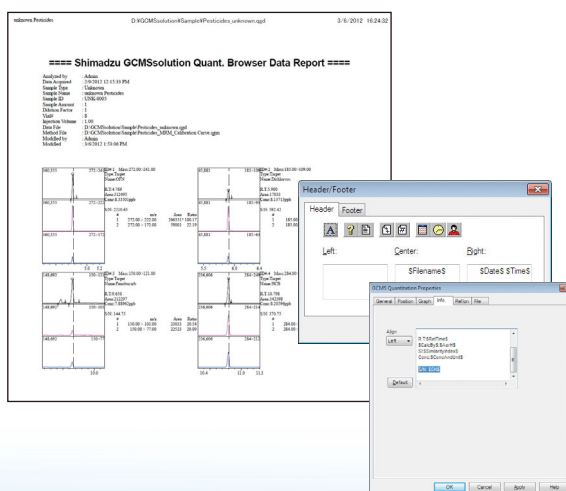


Extensive Report Creation Features

GCMSsolution software allows the user to design, edit, and customize report formats to meet individual program requirements.

Items to be included in reports can be pasted on a blank report page, and size and position modified as needed. Macro functions are also available to display file names or other necessary information.

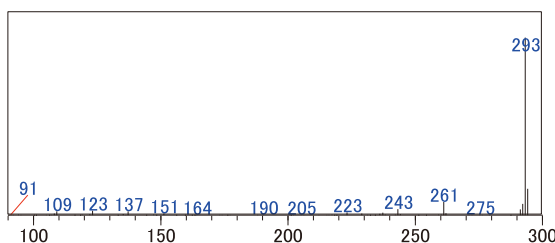
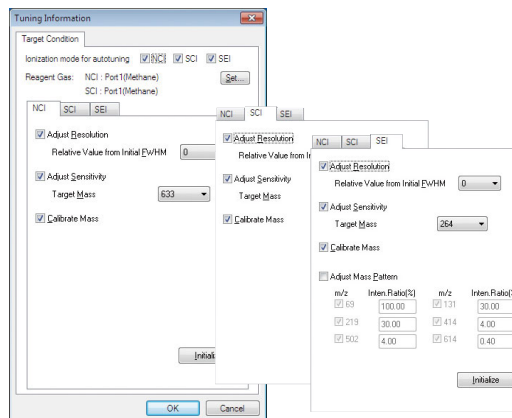
In addition, a generous selection of report templates is available for various applications, so even first-time users can output reports easily.



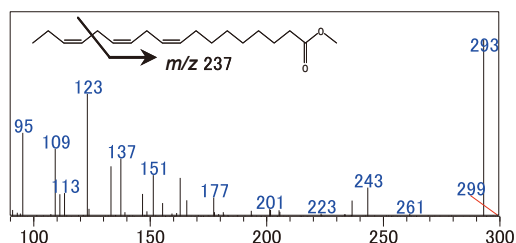
Options

Chemical Ionization Method

In addition to commonly-used electron ionization (EI), both chemical ionization (CI) and negative chemical ionization (NCI) are available. CI is suited for confirmation of molecular weight. NCI can be used to detect functional groups having a large electron affinity such as halogens. Any of three types of reagent gases (methane, isobutane, or ammonia) can be used. Structural information about compounds can be obtained by performing scan and product ion scan measurements.



CI Analysis Results for Methyl Linolenate (Z)
Left: CI-scan; Right: CI product ion scan

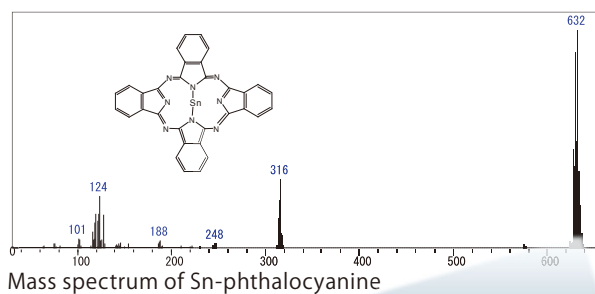


Confirming molecular ions to predict compound structural information

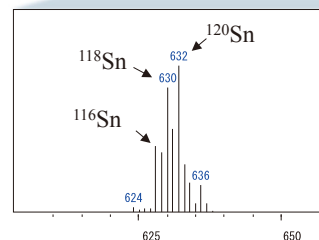
Direct Injection System DI-2010

The DI Probe allows a sample to be introduced directly into the ion source without being passed through a GC column. It is an effective technique for obtaining mass spectra of synthetic compounds that do not chromatograph well. A DI system can be

incorporated into a standard GC-MS configuration without making any changes to the GC. It is then possible to switch between conventional GC column chromatography and DI analysis without making any hardware changes.



Mass spectrum of Sn-phthalocyanine



Components that are thermally degradable or difficult to vaporize are not suited to GC analysis. Their mass spectra can be obtained easily using the DI probe. Above is an example of Sn-phthalocyanine spectra obtained using the DI Probe.

Eco Friendly

Eco-Friendly Design for Lower Running Costs in the Laboratory

There is increasing public interest in reducing running costs and environmental stress. Reducing power consumption is a common concern in order to reduce both a laboratory's energy cost and CO₂ emissions. In addition, helium carrier gas is a

non-renewable, valuable natural resource.

The GCMS-TQ8030 has eco-friendly features for saving power and carrier gas.

Saving Power Consumption with an "Ecology mode" for Reduced Instrument Running Costs

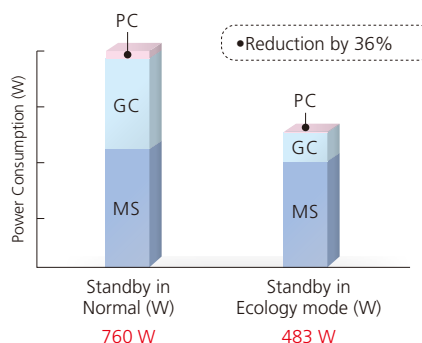
Equipping the instrument with "Ecology mode" reduces the power consumed in analysis standby mode by 36%, compared with the previous model. For nighttime GC-MS operation, Ecology mode can be set automatically, making it possible to reduce unnecessary power consumption.



Ecology mode screen

Reduced Power Consumption in Analysis Standby Mode

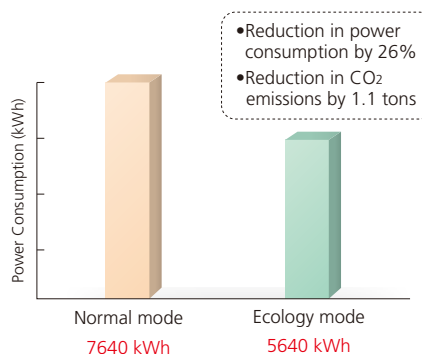
When Ecology mode is entered, unnecessary power consumption by the GC, MS, and PC is automatically eliminated. The consumption of carrier gas is also automatically reduced. Furthermore, Ecology mode can be entered automatically after continuous analysis, so power and carrier gas can be saved automatically after the completion of nighttime analysis.



Reduced Annual Power Consumption

If Ecology mode is used over one year of operation*, power consumption can be reduced by 26% and CO₂ emissions can be reduced by approx. 1.1 tons.

*) This is based on 6 hours of use per day for 260 days under our standard analytical conditions.



Reduces Power Consumption of Indoor Air Conditioning

The ecology mode reduces power consumption during the analysis standby mode. Consequently, it reduces heat output. The ecology mode not only saves

instrument energy, it also helps save on the energy required to maintain the room temperature.

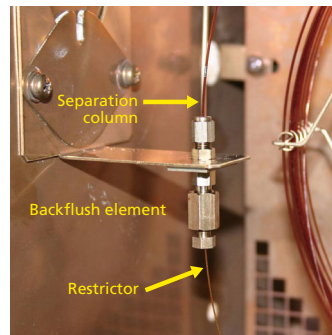
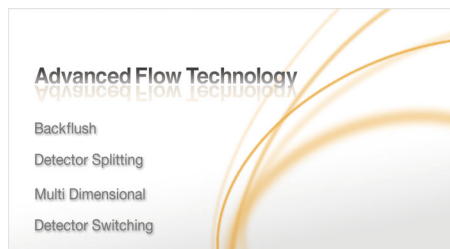


This product is certified compliant with Shimadzu ECO-label standards. It consumes 36% less power than with the ecology mode switched OFF.

Capillary Gas Chromatography System Advanced Flow Technology

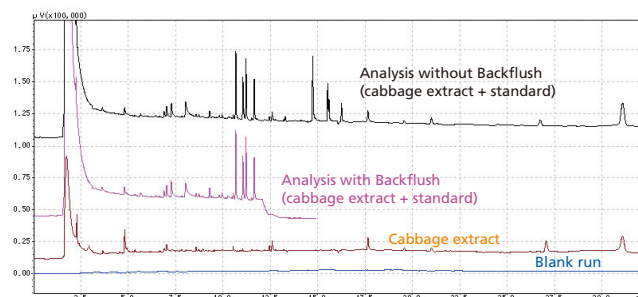
Advanced Flow Technology (AFT) provides enhanced separation power and operational efficiency for applications with complex sample matrices. AFT enables reduced analysis times, enhanced chromatographic resolution, and application-specific configurations without compromising key performance features.

- Heart-Cut System
- Backflush System
- Detector Splitting System
- Detector Switching System
- Multi-Deans' Switching System



Analysis of Cabbage Extract Using a Backflush System

The backflush system reverses the carrier gas flow after the target compounds have eluted to discharge residual late-eluting components in the column through the injection port split vent. Backflush shortens the analysis time and improves productivity. In addition, high-boiling point components are discharged efficiently to reduce the bake-out time (elution time), and thus prevent column deterioration, contamination, and retention time shifts. The example shown here illustrates how backflush reduces analysis time by over 50 percent.



Analysis of Chlorine-Based Agricultural Chemicals in Cabbage





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