New Portable GC-MS for Onsite 'Lab Analysis'

Quantitech (Milton Keynes, UK) has launched a unique portable gas chromatograph toroidal ion trap mass spectrometer (GC-TMS).

"Developed in the USA by Torion Technologies, the TRIDION™-9 is the fastest and most portable GC-MS in the world," says Quantitech's Dominic Duggan. "Combining a high speed GC with a miniaturised TMS in a lightweight, field-portable instrument, the TRIDION-9 GC-TMS is designed to rapidly detect an enormous variety of chemical compounds in liquid, solid or gaseous samples.

TRIDION™-9 GC-TMS

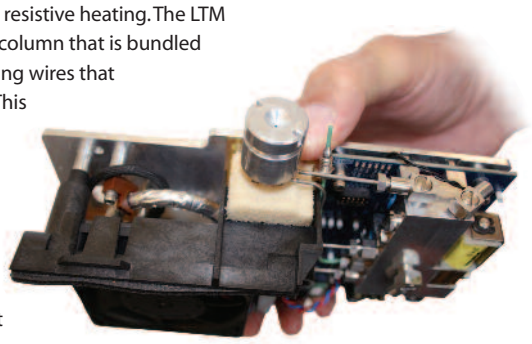
"As a result, users will be able to undertake laboratory-grade analysis in the field, providing accurate, rapid results within minutes of a sample being taken."

The ability to undertake on-site analysis presents a number of major advantages:

- No delay in sample results
- No sample transport costs
- No problems with sample storage during transport
- No 'non-conforming' samples

In addition to environmental applications, Duggan believes that the TRIDION-9 GC-TMS will also provide unique advantages in any situation requiring fast, on-site, high quality analytical data: "It is often necessary to analyse food and beverages, and a portable analyser will be an advantage in instances where results are required either on-site or very quickly. For example, The TRIDION-9 GC-TMS could be used for quality control purposes in the field, in ports, warehouses etc., and it could also be used to quickly investigate potential problems with taste, texture or appearance."

The TRIDION-9 GC-TMS's gas chromatograph is so small it could fit in the palm of your hand. However, although it was built for portability and speed, this low thermal mass (LTM) capillary GC provides equivalent chromatographic resolution and performance to a laboratory capillary GC. The miniature size is achieved by replacing a conventional convectively-heated column oven with a LTM column bundle with direct-contact electrical resistive heating. The LTM GC uses a small diameter, metal capillary GC column that is bundled with resistive heating and temperature-sensing wires that are braided together with insulator strands. This provides for greater heating and cooling speeds and very low power consumption, which extends battery-powered operating time.



Low thermal mass capillary GC

The powerful combination of direct resistive heating and rapid temperature ramp rates allows the GC to handle the most challenging analytical tasks very quickly; separating analytes in just seconds.

Reproducibility

The miniaturised electronic pressure control system stabilises helium flow, which increases chromatographic performance and reproducibility. MS reproducibility is also improved because constant helium flow into the ion trap is maintained. High run-to-run reproducibility allows for accurate target compound identification. In trials, retention time reproducibility for 11 peaks was ≤2.58 % RSD over 80 analytical runs.

True portability is achieved with a miniaturised mass spectrometer

Torion's innovative Toroidal Ion Trap Mass Spectrometer (TMS) configuration is ideally suited for miniaturisation compared to other types of mass spectrometers, such as conventional cylindrical ion traps or linear quadrupole traps. Every component of the TMS has been designed to maximise signal and minimise noise. The novel TMS configuration allows for an adequately large trapping volume despite its small size. This provides high ion counts that result in good sensitivity, low noise levels and excellent spectral quality.

The TRIDION-9 mass analyser runs at 175°C and operates under vacuum so that the electrodes stay cleaner longer. This reduces the need for frequent maintenance, while increasing mass spectral quality and reproducibility. Performing at an elevated temperature also leads to long-term MS resolution stability. The TRIDION-9 TMS provides better than unit mass resolution over the 45-500 amu mass range.

Miniaturised Toroidal Ion Trap Mass Spectrometer (TMS)

Advantages of toroidal ion trap technology

Ion traps are smaller than other mass analysers, which is beneficial because smaller ion traps can operate at high pressure (~10^{-3} Torr), so the vacuum requirements are less onerous, allowing for smaller pumps which reduces both size and weight. As a result, the TRIDION-9 is able to operate from battery power for longer than any other field portable MS.

Speed, resolution and sensitivity

Most chromatographic peaks on the TRIDION-9 are about 1sec wide, meaning 60 compounds can be fully resolved and analysed in 1 minute. The scan rate of the MS is also fast at 10 - 15 scans per second. This provides multiple scans across the narrow chromatographic peaks resulting in excellent mass spectral quality.

A number of automated functions have been designed into the TRIDION-9; based on novel advanced algorithms, these ensure optimum performance at all times. For example, an AutoTune function automatically optimises filament emission, signal resolution and EM detector optimisation, and an AutoCal function ensures that the Mass and GC retention scales are automatically calibrated. In addition, an AutoIon function automatically adjusts the ionisation time based on the concentration of analyte(s) in the TMS. This results in consistent ion loading of the trap and a reduction of space charge effects. Ultimately this leads to improved and consistent mass resolution and sensitivity.

Dedicated software for trace compound recognition

Simple to operate and able to produce results in under 3 minutes, the TRIDION-9 GC-TMS can be operated with the unit's touchscreen display. However, the instrument is supplied with easy-to-use CHROMION™ operating software which facilitates configuration, data display and processing.

The TRIDION-9 on-board library identifies target compounds in a table that is displayed on the instrument's touch screen. The CHROMION™ software enables users to custom build target compound libraries. Unique deconvolution algorithms ensure reliable identification of even co-eluting compounds in complex mixtures and the software works in conjunction with the extensive NIST Library database, so unknown peaks can be easily identified.

Sampling – gas, liquid and dissolved solids

Solid phase microextraction (SPME) is an innovative sampling technology that is quick, easy and reliable. SPME is a solvent-free technique that combines sample extraction, collection and concentration of analytes in one simple step.

SPME sampling syringe

The SPME fibre coating retains chemical compounds from the sample matrix. The fibre coating is typically an immobilised polymer, a solid adsorbent or a combination of the two.

Following sample collection, the SPME fibre is inserted directly into the heated injection port of the GC. Analytes are thermally desorbed in the injector, separated in the GC column, and detected by the TMS. CUSTODION™ SPME Syringes can be reliably used for on-site field sampling or in-laboratory applications. A variety of SPME phases are available to specifically target different groups of analytes for maximum extraction efficiency.

Field Calibration

In order to avoid the necessity for impractical laboratory glassware and chemicals, field calibration, including both mass and retention time calibrations, has been greatly simplified by the development of CALION™ PV Mixes - calibration and performance validation standards.

These contain standard compounds that are carried in solidified liquid particles, where the compounds maintain equilibrium between the solid particles and the vial's headspace. CUSTODION™ SPME sampling of the headspace results in the collection of analytes on the SPME fibre from the vapour phase. The collected standards are then injected into the TRIDION-9 GC-TMS for analysis.

CALION™ Performance Validation Standard

Summary

Quantitech's Dominic Duggan believes that the development of the TRIDION-9 GC-TMS represents a quantum leap forward in the growing trend toward on-site analysis: "Talk to any analytical laboratory and they will tell you that their clients take accurate results for granted. However, they will also tell you that their greatest wish is for faster results, so for those tests that do not need to be conducted in a UKAS accredited environment, field testing offers the fastest route to data.

"Offering extremely low detection levels, in a portable, simple-to-use instrument, the TRIDION-9 GC-TMS is a game changer; offering laboratories the ability to dramatically enhance their capabilities, and offering users the chance to avoid the time delay, cost and hassle of sample transportation."

For more information, visit www.quantitech.co.uk

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