

Automate and track your sample-handling workflow

Easily program the Thermo Scientific™ TriPlus™ RSH SMART Autosampler for integrated sample preparation with operation traceability

Overcome the challenges of sample preparation

When gas chromatography (GC) or gas chromatography mass spectrometry (GC-MS) analysis is performed, several manual procedures are required in the laboratory to prepare the sample prior to the injection, with the purpose of making it amenable to GC analysis, or to increase sensitivity through analytes enrichment, or simply to prepare standard solutions for instrument calibration.

Sample preparation normally involves multiple steps such as extraction, clean up, dilution, standard addition, derivatization, mixing and heating. More than 60% of the time spent in a chromatographic analysis can be dedicated to sample preparation.

Additionally, approximately 30% of possible sources of analytical error are due to manual sample handling (i.e., sample loss and/or sample contamination), with significant consequences on the analytical data accuracy and precision.

The Thermo Scientific™ TriPlus™ RSH SMART Autosampler is a robotic platform enabling SMART technology for consumables ID recognition and usage tracking. It is capable of combining highly versatile sample introduction with automated and fully traceable sample preparation procedures. The typical bottle-neck of manual GC and GC-MS analytical workflows can be eliminated by this autosampler through fully unattended operations and automated tracking of SMART consumable usage, for increased confidence in the analytical results. Basic and advanced sample preparation procedures can be performed by batching samples before the GC analysis or sequentially by optimizing the overall cycle time through overlapping capabilities.

Advantages of sample handling automation:

- Higher sample throughput
- Improved data repeatability
- Increased laboratory efficiency by unattended routine operations
- Reduced cost per sample
- Enhanced confidence of the analytical results

- ▶ TriPlus RSH SMART Autosampler with Thermo Scientific™ ISQ™ 7000 Single Quadrupole MS System coupled to Thermo Scientific™ TRACE™ 1310 Gas Chromatograph



Error-free sample handling

The Automatic Tool Change (ATC) provides the foundation for automated basic and advanced sample handling and sample preparation procedures. The automatic selection of the suitable tool permits different injection techniques like liquid, static and dynamic headspace, and solid phase microextraction (SPME) to be executed within the same sample sequence in a fully unattended way. Up to 6 different tools can be programmed for extended sample preparation capabilities. With that, different liquid syringes can be dedicated to specific operations like standard addition or dilution, minimizing possible cross contamination.

Several tools are available to reliably automate the most common sample preparation procedures, including on-line microSPE clean-up of QuEChERS extracts, and to achieve the highest level of sample handling flexibility. Combined with high sample capacity, the TriPlus RSH SMART autosampler overcomes stringent productivity requirements.

SMART syringes and SPME/SPME Arrow fibers are automatically recognized by the autosampler to further streamline the workflow through error-free operations. Additionally, the SMART technology allows to track consumables usage and conditions, locally and through the chromatography data system, supporting GLP accreditation.



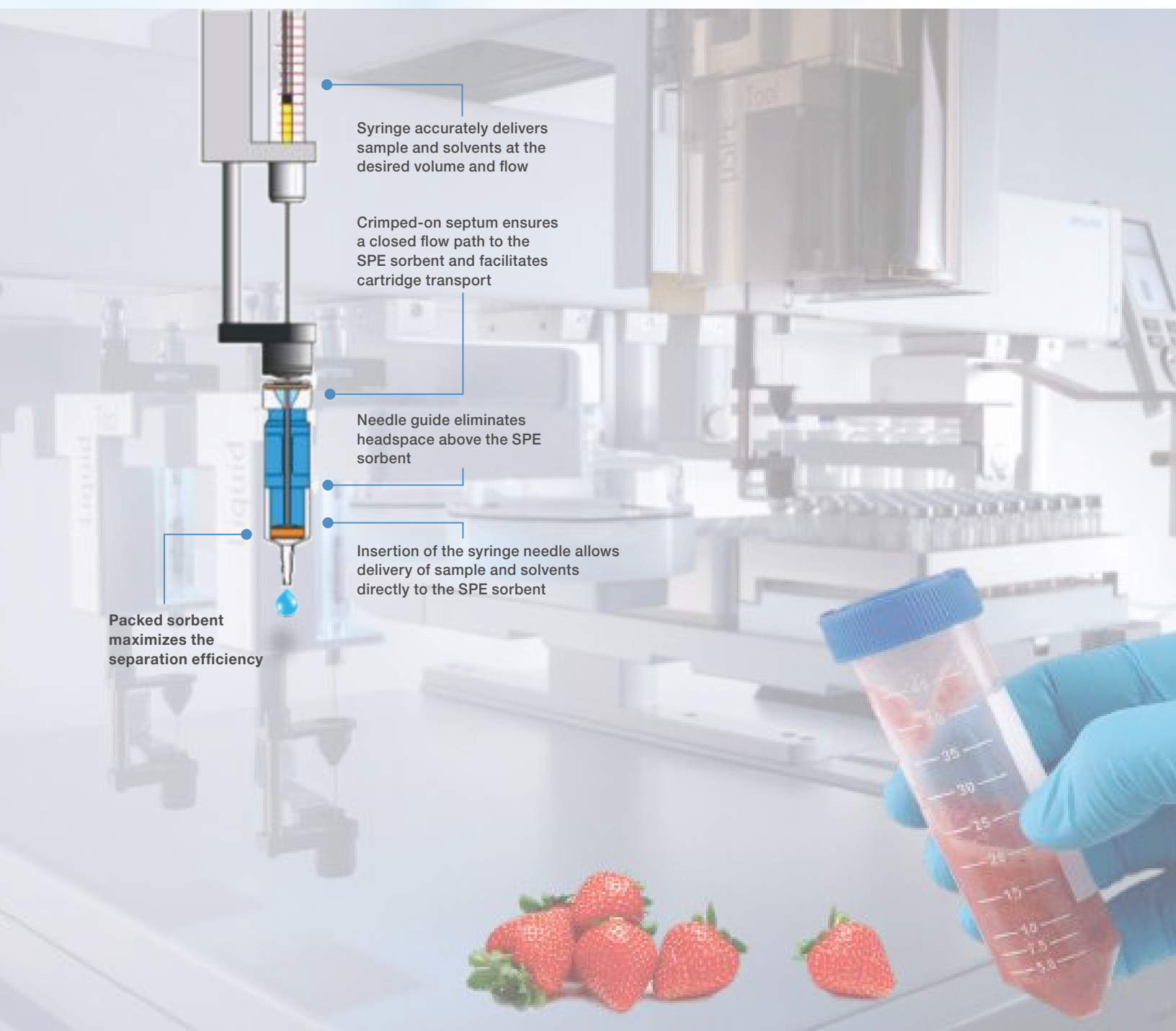
Automated clean-up of QuEChERS extracts of foods

Evolve from manual clean-up operations to automated miniaturized cartridge-base μ SPE

Automated μ SPE clean-up available on the TriPlus RSH and TriPlus RSH SMART autosamplers allows modern laboratories to gain reliable high throughput operations for GC-MS analysis of pesticides in a wide variety of food matrices, even those with high lipid contents.

Replacing manual clean-up procedures with a fully automated on-line approach maintains the efficiency of the [QuEChERS extraction](#), while offering the benefits of eliminating human errors and scaling down sample volume and solvent consumption.

The miniaturization of the clean-up step to a microliter scale solid-phase extraction prevents the typical dilution during manual SPE operations, thus avoiding an additional evaporation step. The pesticides fraction is eluted only in a small volume of a few 100 μ L for direct injection into the GC-MS system.



Higher selectivity and extended instrument up-time

Discover the benefits of the μ SPE clean-up automated workflow

Unlike classical SPE using a vacuum manifold, the flow rate applied to the μ SPE cartridge can be precisely controlled with a liquid syringe on a TriPlus RSH autosampler, ensuring optimum selectivity and recovery.

The μ SPE cartridge is sealed by a septum allowing the autosampler syringe to push the raw QuEChERS extract through the sorbent bed. The syringe works as an LC pump. Low flow rates of approx. 2 μ L/s in the load and elution steps are used for sharp analyte/matrix separation.

- **Automated workflow**

Reduced manual errors and extended unattended operation

- **Optimized sorbent material**

Single type cartridge for hundreds of pesticides in many different food matrices

- **Higher selectivity**

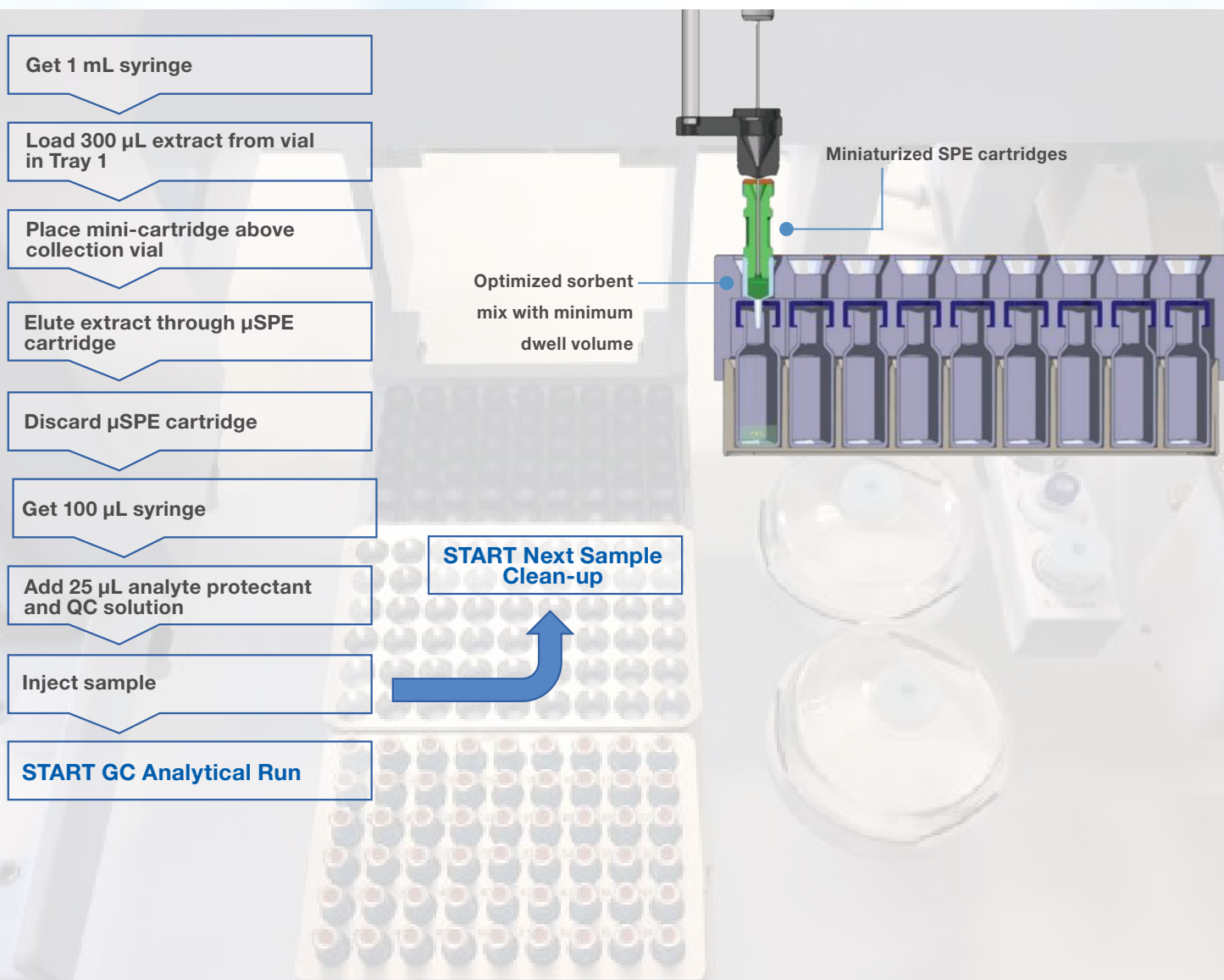
Cleaner extract for an extended instrument uptime

- **Miniaturization to microliter scale**

Less sample and solvent consumption with no concentration step required

- **Optimized cycle time through overlapping**

Fast clean up step <10 min run in parallel to the chromatographic separation of the previous sample



Gain control of your TriPlus RSH SMART Autosampler

Let the robotic capabilities of the TriPlus RSH SMART autosampler perform daily sample preparation workflow – from samples and standards dilution up to more complex derivatization protocols – automatically and reliably.

Actions such as sequential dilution, calibration dilution, standard addition, batch and sequential sample derivatization, heating/mixing and vortexing are now at your fingertips to easily create your automated workflow.

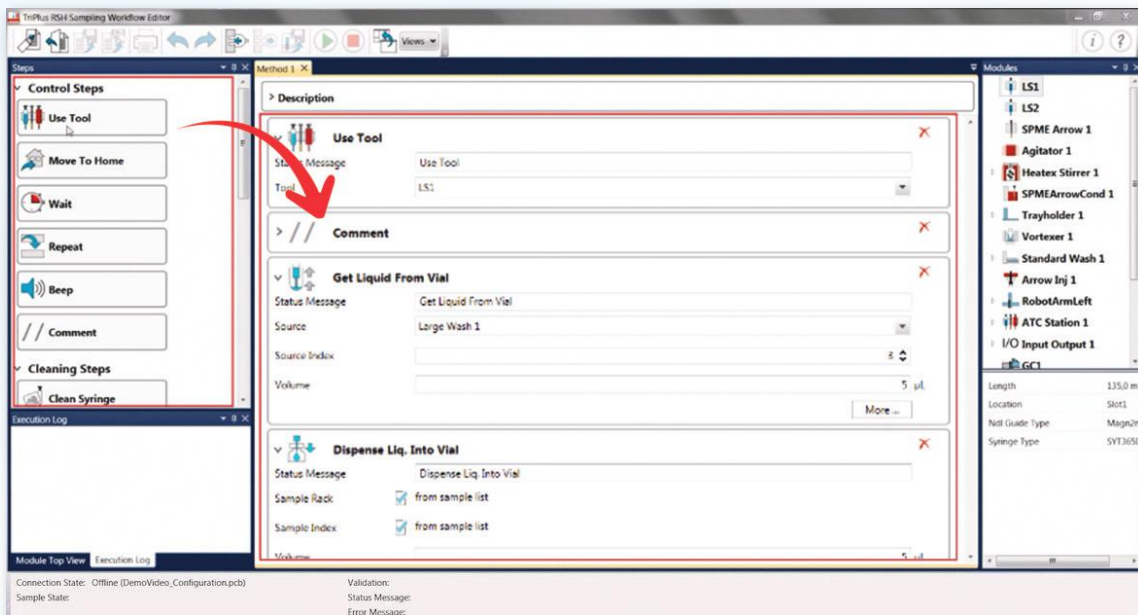
Ready-to-use PrepCycles are pre-compiled set of basic operations to go beyond standard injection functions and are available within the TriPlus RSH SMART autosampler as a default. Additional dedicated PrepCycles can be developed on-demand by the factory to satisfy specific requirements. And now you can gain extra control of your autosampler for user-programmable workflows that very easily fulfill routine sample handling needs.



Easily instruct the TriPlus RSH SMART autosampler to perform daily sample handling operations for you, in a fully automated way, with the Thermo Scientific™ Sampling Workflow Editor software.

Simply connect the Sampling Workflow Editor software to the TriPlus RSH SMART autosampler and all the configured tools will be automatically recognized. Then, you can play with all the actions compatible with your tools, through an easy drag-and-drop approach, to program your own sample preparation workflow.

▶ Visit www.thermofisher.com/SamplingWorkflowEditor to view the video demonstration.



Sequential dilution

A high concentration standard is automatically diluted to easily meet your requirements.



Sequential dilution

Calibration dilution

Reliability and precision for your quantitative calibration. Prepare calibration levels with or without internal standards.



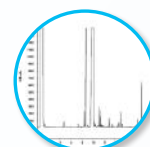
Calibration dilution with internal standard

Standard addition

Add increasing amounts of standard to any sample. Calibrating by standard additions is commonly used in headspace and SPME analyses. The accurate addition of standards is now a reliable, automated step in the measurement cycle.

Sample derivatization

Derivatization steps for repeated batches of up to six samples or sequentially for immediate injection to prevent sample degradation.



Automated derivatization and internal standard addition

Heating/mixing

Vials undergo automatic agitation after the addition of standard volumes. You can also speed-up headspace and SPME applications by reaching the equilibrium faster.



Incubator for mixing and derivatization

Vortexing at ambient temperature

Physical vortexing for thorough mixing can be used for liquid homogenization and extraction steps with solvents.



Vortex mixer utilizing different vial sizes

Centrifugation

Essential tool for phase separation, supporting automated liquid-liquid extraction with micro volumes.



Centrifuge for phase separation compatible with flammable solvents

Ambient temperature headspace*

Perform static headspace injection skipping the incubation step, for temperature sensitive samples.

Ambient temperature SPME*

Perform SPME injection skipping the incubation step, for temperature sensitive samples.

**only available through PrepCycle scripts*

▶ Sampling Workflow Editor user interface. Intuitive visual programming of your autosampler through drag-and-drop motion.

Boost sample preparation in food analysis

Fatty Acid Methyl Esters (FAME)

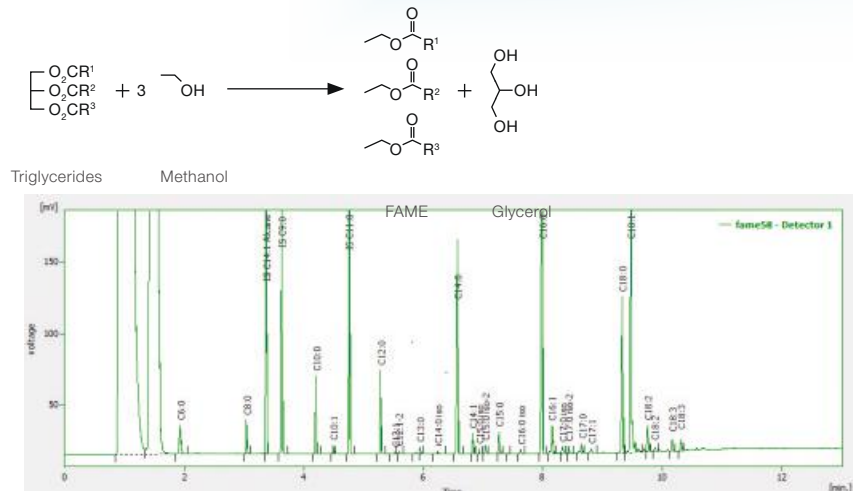
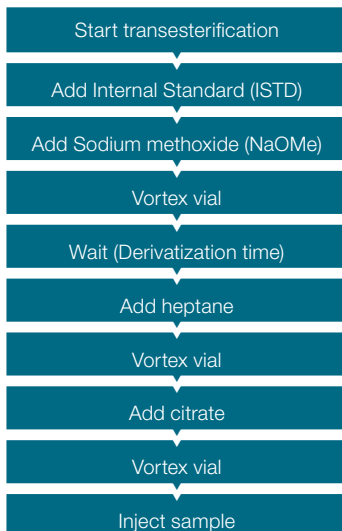
Fatty acid profiling is a key analytical determination for the food industry, impacting several segments like quality control, nutritional labeling, food design as well as vegetable oils blending and counterfeit assessment.

Transesterification protocol can be fully automated to get a 90 second per sample derivatization method for the TriPlus RSH and TriPlus RSH SMART autosamplers, increasing productivity and preventing humans' exposure to hazardous chemicals.

A dilutor module is used to dispense reagents and for intermediate washing steps with methanol and water, while the vortex mixer guarantees rapid mixing.

- ✓ Biodiesel quality assessment
- ✓ Fat content in food
- ✓ Trans fatty acids
- ✓ Polyunsaturated fatty acids (PUFA) in fish oils

Rapid transesterification workflow*



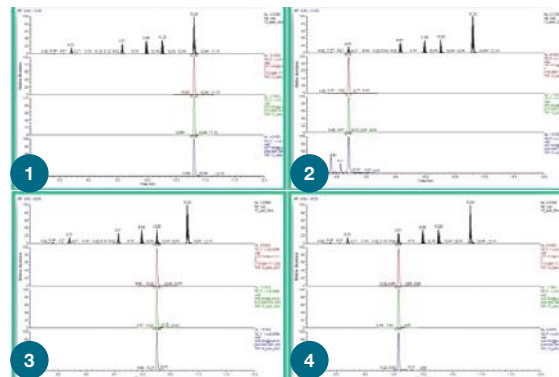
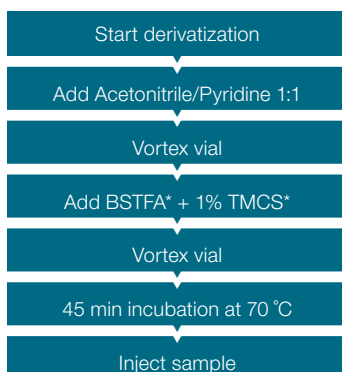
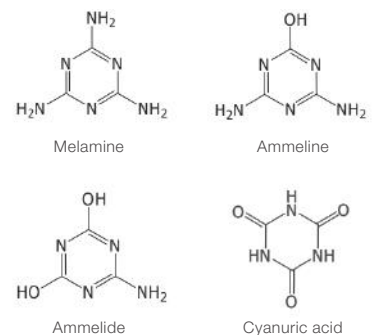
▲ Typical result of butter FAMES. Complete GC separation within 11 minutes.

*Schilling B., Bollinger R., Böhm G., Application Note CTC 01/2014

Melamine and its derivatives in dairy products

Melamine and cyanuric acid are inexpensive, nitrogen rich compounds which can be used as adulterants in food and/or feed to increase their market value by increasing their protein content. Milk and dairy products are particularly prone to such adulteration, this way impacting also the processed food containing dairy-based ingredients.

Following the sample extraction, which is performed according to the United States Food and Drug Administration (U.S. FDA) protocol, the TriPlus RSH and TriPlus RSH SMART autosamplers can automate the derivatization procedure, with subsequent injection into the GC-MS/MS system. This approach improves the laboratory throughput with excellent analytical performance.



- ▶ SRM results for the compounds screened. (1) Melamine, (2) Cyanuric Acid, (3) Ammeline, (4) Ammelide.

▶ Visit www.thermofisher.com/automated-workflows to know more.

*N,O-Bis(trimethylsilyl)trifluoroacetamide (BSTFA), trimethylchlorosilane (TMCS)

Thermo Scientific chromatography consumables are designed to complement our innovative range of GC and GC-MS systems together with our autosamplers. Get the most out of the TriPlus RSH SMART autosampler by pairing it with advanced, high-performance Thermo Scientific products.



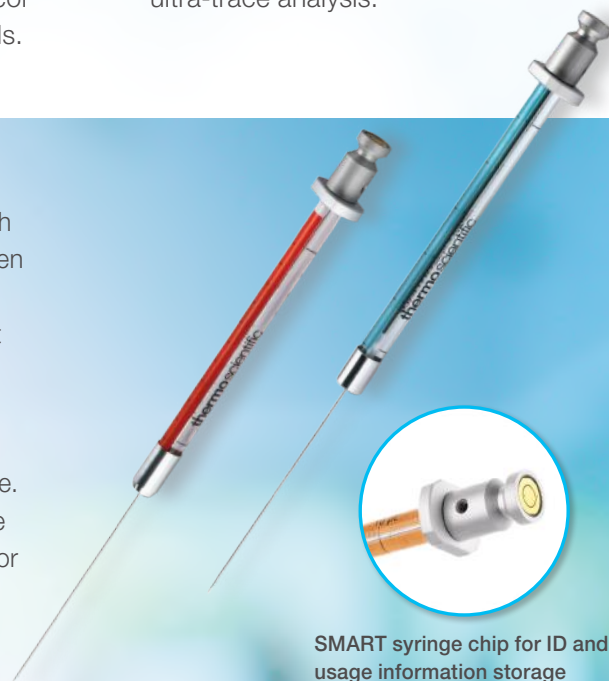
► **Learn more about
GOLD-Grade Inert Vials**

Have you ever thought about the quality of your glass vial? Especially when you need to detect small concentrations or certain structures of analytes, it's important to preserve your sample integrity right from the start with vials. For your sample preparation workflow, maximize your sample performance and lessen the number of failed assays with Thermo Scientific™ Chromacol™ GOLD-Grade Inert Glass Vials.

These vials offer the most state-of-the-art technology in the industry for the analysis of critical low detection limit analytes, and when sample quality, reproducibility, security, and integrity are of utmost importance. For easier sample handling and less risk of sample loss, the GOLD-Grade Inert Vials are the best-in-class choice for all chromatography users performing ultra-trace analysis.

Achieve error-free sample handling and electronic tracking capability using Thermo Scientific™ SMART GC Syringes and SPME/SPME Arrow fibers with the TriPlus RSH SMART Autosampler. Read/write ID chip on each field-proven syringe and SPME fiber allows an automatic connection to the TriPlus RSH SMART autosampler for information exchange. Key information such as part number, lot number, usage parameters, operational ranges and history for that specific consumable are stored in the chip. This information is directly accessed and reported via Chromeleon CDS, integrating consumables identification and usage tracking into an audit trail log file for GLP compliance. The combination of smart syringe technology and Chromeleon CDS with the TriPlus RSH SMART autosampler provides an entirely automated workflow for full traceability in compliance with regulatory protocols.

► **Learn more about GC SMART Syringes**



SMART syringe chip for ID and usage information storage

The wide range of vials, septa, capillary columns and accessories offers application-focused solutions that are ideal for pharmaceutical, forensics/toxicology, environmental, food analysis, petrochemical and general analytical industries.

Find out more at

thermofisher.com/triplusrsh

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