AUTOMATION QUICK GUIDE

Offline Prep ▪

Full Integration ▪

SRA

INSTRUMENTS
ANALYTICAL SOLUTIONS

E-PREP ONE

Offline Prep

E-prep One is a compact and versatile liquid handler that offers **syringes workflows and other extra features.**

The user interface is designed to be extremely simple and intuitive with pre-validation and physical check to simplify the user experience and avoid unexpected interruptions.

Up to **12 different syringes** from 5 to 10.000 μL can be selected and automatically exchanged during the workflows, in addition, **filtration, SPE and micro-SPE** options expand the system capabilities.

The samples are directly prepared on **instrument-specific racks** and trays in order to transfer the treated samples to the further analytical steps on any instrument brand.

The racks can be placed on **agitation** slots to provide efficient sample mix during the workflows.

Calibration curve of Tri-nitrobenzene from an ePrep 5μL-80μL serial dispense. $R^2 = 0.9997$
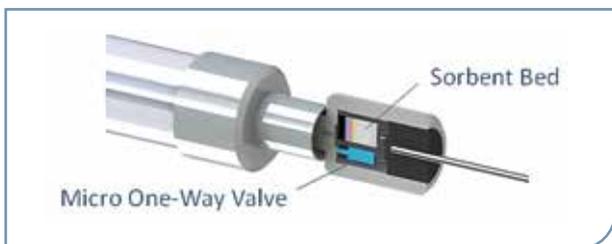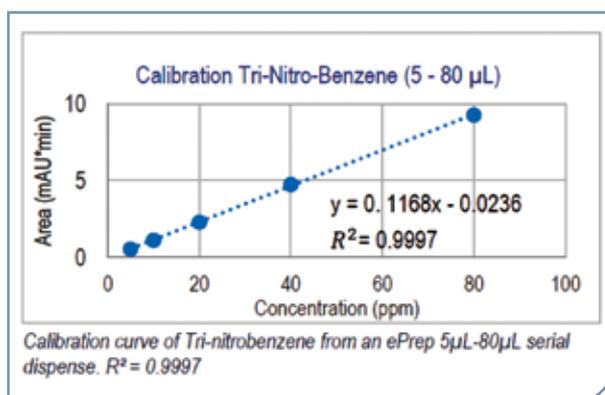
COMMON APPLICATION:
Sample spikes, calibration curves, derivatization, filtration, SPE, μSPE.

RAYKOL / FOTECTOR

Offline Prep

≡RayKol
Knowledge Optimized Laboratory

The **RayKol FOTECTOR** is an **advanced parallel SPE extractor**.

The system is compatible with 1, 3, 6, 12, and 20mL SPE cartridges.

2, 4, 6 or 8 samples can be processed simultaneously with fully independent flow paths to maximize the productivity providing **autonomous operation up to 80 samples** (fotector-08HT).

The system is designed for maximum flexibility: the sample can be supplied in vials **from 10 to 60mL or from large bottles (1-2L)**. The SPE can be eluted as well in vials from 10 to 60 mL

All the liquid handling is performed with high accuracy independent syringes through a stream selection valve that allows **automatic sample rinse, SPE conditioning, SPE drying and SPE elution of the SPE cartridge using up to 8 different solvents**.

In order to allow the **PFAS** concentration and clean-up the Fotector is also available in dedicated version where all the tubing and fittings are replaced with PFC free materials like PEEK.
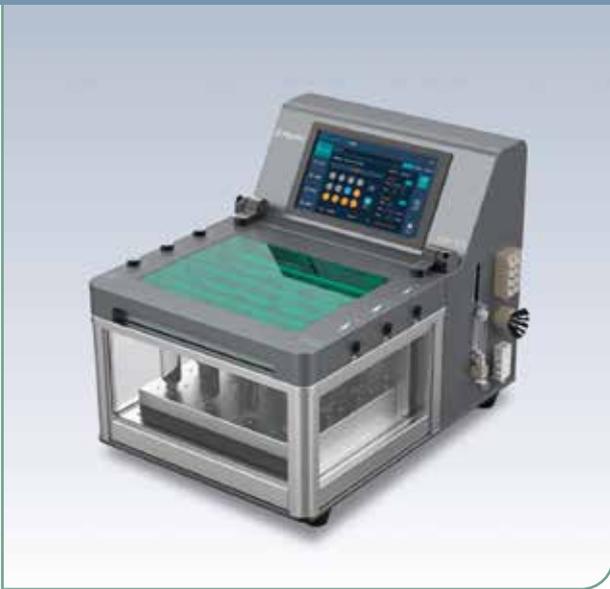

conditioning   loading   washing   drying   eluting

Detection of Perfluorinated Compounds in Drinking Water

Pre-treatment Process

COMMON APPLICATION:
Pesticides and PFAS in water samples.

RAYKOL / EVA 12 / EVA 80

Offline Prep

The **RayKol EVA series** includes an **advanced parallel nitrogen** evaporation set of systems where the evaporation of the samples can be performed with the highest standard of accuracy and repeatability.

Endpoint detection and i**ndependent mass flow controllers** allows the operator to fine tune the evaporation phases.

The **EVA 12** is a high-capacity evaporator, that can hold up to 12 vessel **from 50 to 250mL**.

The water bath compensates the temperature loss and increases the evaporation speed while the nitrogen il blown through a tilting needle to ensure efficient evaporation.

In addition, a **solvent sprinkle** can wash the vessel walls during the evaporation to increase the recovery of the most volatile compounds and an **end point optical detection** can stop each channel at a precise level.

The **EVA 80** is a flexible evaporator, that can process up to 80 vials from **10 to 100mL**.

The water bath compensates the temperature loss and increases the evaporation speed while the nitrogen il blown through a moving needle array that follow the liquid surface to ensure efficient evaporation without sample sprays.

Each needles line is operated with a dedicated mass flow controller and an endpoint detection to allow the system to perform reproducible evaporations.

The needle array is extremely easy to be replaced and maintain by the customer due to the easy access.

CTC PAL / CHROMLINE

Offline Prep

The **CTC PAL** with a legacy of more than 30 years, provides the most flexible **XYZ platforms for the laboratory automation**. A broad variety of tools and main frame can be combined to create **bench workflow as well as integrated solutions "on top" of the instruments**.

The CTC PAL frames are available in many sizes from 50cm to 160cm with **one or two heads** and the optional **Robotic Tool Exchange** where the system can engage different tools during the operations.

To create custom workflows CTC offers a broad variety of tools and modules, in addition the partnership that SRA has developed with **CROMLINE expands the possibilities with custom Rack and Trays and tools**.

The following items are some of the most common modules used in the bench and integrated solutions.

Liquid Syringe Tools

85 mm. needle length

57 mm. needle length

Tools for 57 mm or 85 mm syringe needle lengths and available in different syringe volumes:

- 1.2 μL / 10 μL / 25 μL / 100 μL with D7 tool
- 250 μL / 500 μL / 1'000 μL with D8 tool
- 5'000 μL / 10'000 μL with D18 tool.

Pipette Tools

Automated pipetting with available with 20 μL, 200 μL or 1000 μL tips. The pipette tool can work with capped vials with the Decapper Module in single or multi-dispense mode.

Dilutor Tools

The Dilutor tool enables the addition of larger amounts of liquids, nevertheless with the special "transfer" mode also small volumes can be dispensed with high accuracy.

The 80 mm needle allows aspiration of samples from 10/20 mL vials.

Vortex Mixer Module

The vortex Mixer allows efficient mixing also when dilutions and extraction has to be performed:

- Standard vial sizes: 2 mL / 10 mL / 20 mL
- 1 additional slot for custom specific vials
- Provides efficient mixing with up to 2000 rpm.

Agitator Module

The Pal Agitator allows the thermal incubation and a soft mixing of the samples:

- 6 positions for 20, 10, 2 mL vials
- Temperature range 40 - 200 °C
- Agitation speed 250 - 750 rpm.

Peltier Stack Modules

In order to preserve the sample thermal stability or to use clear vials for light sensitive compounds, CTC offers the possibility to store the sample in a multi plate refrigerated drawer:

- For the storage of two (2DW) or 6 (6DW) racks
- Defined temperature conditions between 4 °C and 40 °C.
- Capacity example each drawer:
  - 2 x DW (Deep Well Plate)
  - 2 x VT15 (15 x 10 mL)
  - 2 x VT 54 (54 x 2 mL).

Centrifuge Module
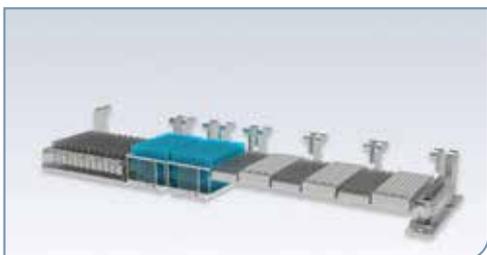

Rotor 2mL

Rotor 10mL

Rotor Combi

Most sample preparation requires the separation of two liquid phases or solids decantation.

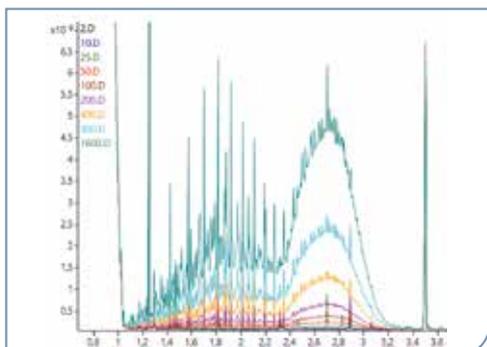The high-end centrifuge can speed up this process making the whole sample-prep quicker and more reliable:

- **Relative centrifugal force: up to 5600 x g**
- **Sample capacity:**
- **Combi rotor 4x2 mL, 2x10 mL, 2x 20 mL**
- **8x 2 mL**
- **6x10 mL**
- **6 x 2 mL and 4 mL.**

Decapper Module

Piercing the vial septum can cause contamination of the sample, analytes losses, or, in certain application is not mechanically possible (pipetting) the decapper open and closes 2, 4, 10 and 20 mL screw cap vials without any change of hardware (no adapters required).

Defined torque guarantees the reproducible and leak-tight closing of headspace vials.
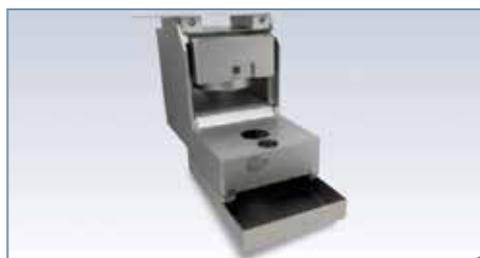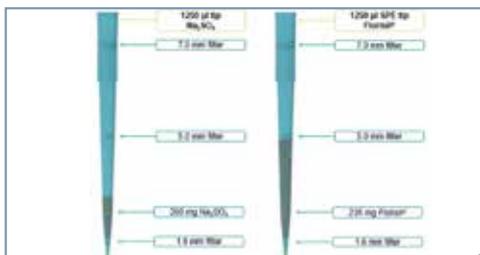
CHROMLINE - custom racks and trays

Any workflow needs a **tailor-made** and robust approach: the cooperation between Chromline and CTC ensures the perfect integration of custom designed trays into the CTC platform.

The custom trays can fit flexible vial size and number, in addition they can be optionally refrigerated.

CHROMLINE - "in-tip" cleanup

Clean-up steps are often tedious and time consuming,

The **"In-Tip" cleanup** allows easy and straightforward automation as well as manual operation. The sample is aspirated and dispensed at a controlled flow allowing the interaction with the stationary/clean-up phase; some of standard packaging are: Florisil®, C18, Silica, Anhydrous Sodium Sulphate but custom tips can be easily provided.

EXAMPLE APPLICATION:
Mineral Hydrocarbons.
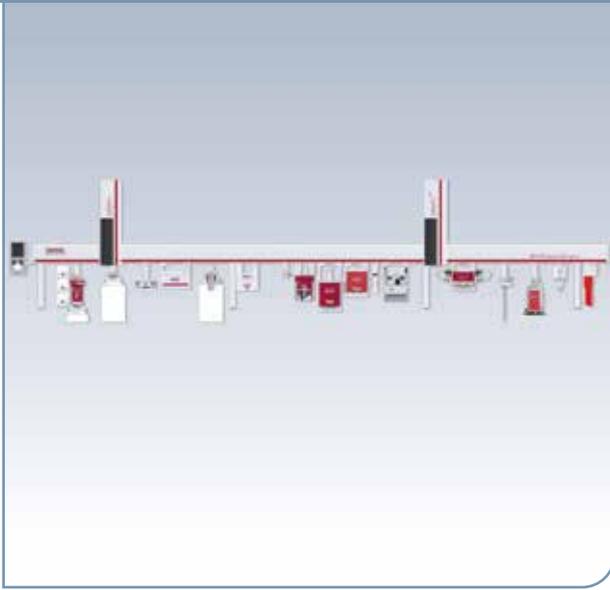
GERSTEL

Offline Step

With a legacy of more than 30 years, GERSTEL based the MPSRobotic XYZ platforms on the CTC PAL mainframes. One of the main added value from Gerstel is a **dedicated flexible software** that fully integrates with the Agilent GC and GCMS; in addition the e**xpanded portfolio of unique modules** extends the sample handling possibilities.

The MPS frames are available in many size from

50 cm to 300 cm with **one or two heads** with the optional **Robotic Tool Exchange** that allows the system to engage different tools during the operations.

The following items are some of the most common modules that GERSTEL can add to the standard CTC portfolio like centrifuges, decapper, mixers, etc.

Mixing Modules

A complete set of specific mixers for any need:

- **Incubator/agitator for 2,4,10 and 20mL vials with the possibility of using magnetic stir bars**
- **40 mL vial incubator agitator**
- **Quick mix for effective mixing and LL extraction.**

Evaporation

- **Multi position (6 vials) vacuum evaporation**
- **Concentration is performed at user defined temperature, agitation and vacuum levels.**

Filtration

- Commercially available standard filters are fitted with transport adapters and cannulas
- The standard filtration option can be upgraded at any time with the Fast Filtration option.

Large wash and solvent modules

- Large wash station allows to support the extensive cleaning requirements
- Solvent filling station allows to handle large solvent volumes (extraction/SPE).
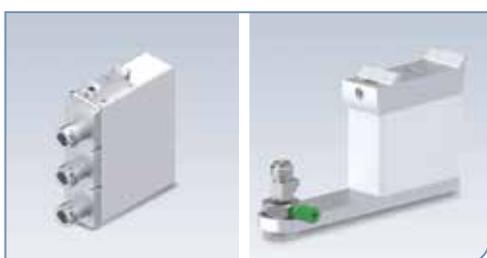
Solid Phase Extraction

- Standard SPE cartridges: 1 mL, 3 mL, and 6 mL
- Transport adapters fitting.

UltraSonic

- Sample is transported into the ultrasonic bath
- Large drops of water are removed from the vial at a special dripping-off position.

Valve drives and flow cells

- Multiport valves
- Allows HPLC interfacing for both injection and stream handling.

CHROMLINE

Full integration

After more than 20 of activity in the on-line measurement and GC-GCMS solutions **SRA has developed a broad portfolio to comply with highest standard of performance and productivity**. The integrated systems allow the sample to be **prepared and analyzed with a single platform** that combines the sample preparation steps with the injection. The following example are some of the most common applications.

SVOC and pesticides - SPME

Solid Phase Micro Extraction is an effective way to collect the target analytes from the sample matrix.

Combining the sampling phase (immersion, headspace) and the fiber coating chemistry, the technique can be extremely selective providing concentration and "clean-up" in the same step allowing quantification at ppt levels. CTC offers a dedicated tool for SMART SPME and a dedicated tool for SMART SPME ARROW in addition each tool can mount only one fiber at a time and the fiber replacement need the user intervention.

Developed for the offline SPME sampling, the Chromline **MFX-FFA Tool can engage different fibers** from a tray allowing:

- **SPME and SPME ARROW with only one tool**
- **Multi Fiber eXchange**
- **Multiple SPME experiments to run autonomously on the same sample set**

The system is especially useful for a comprehensive SPME approach where the same sample is processed with different fibers to complete a sensitive and accurate multi components screening, one of the most relevant example is the SVOC and more than 100 Pesticides.

More than 100 pesticides in water LOQ < 5ppt
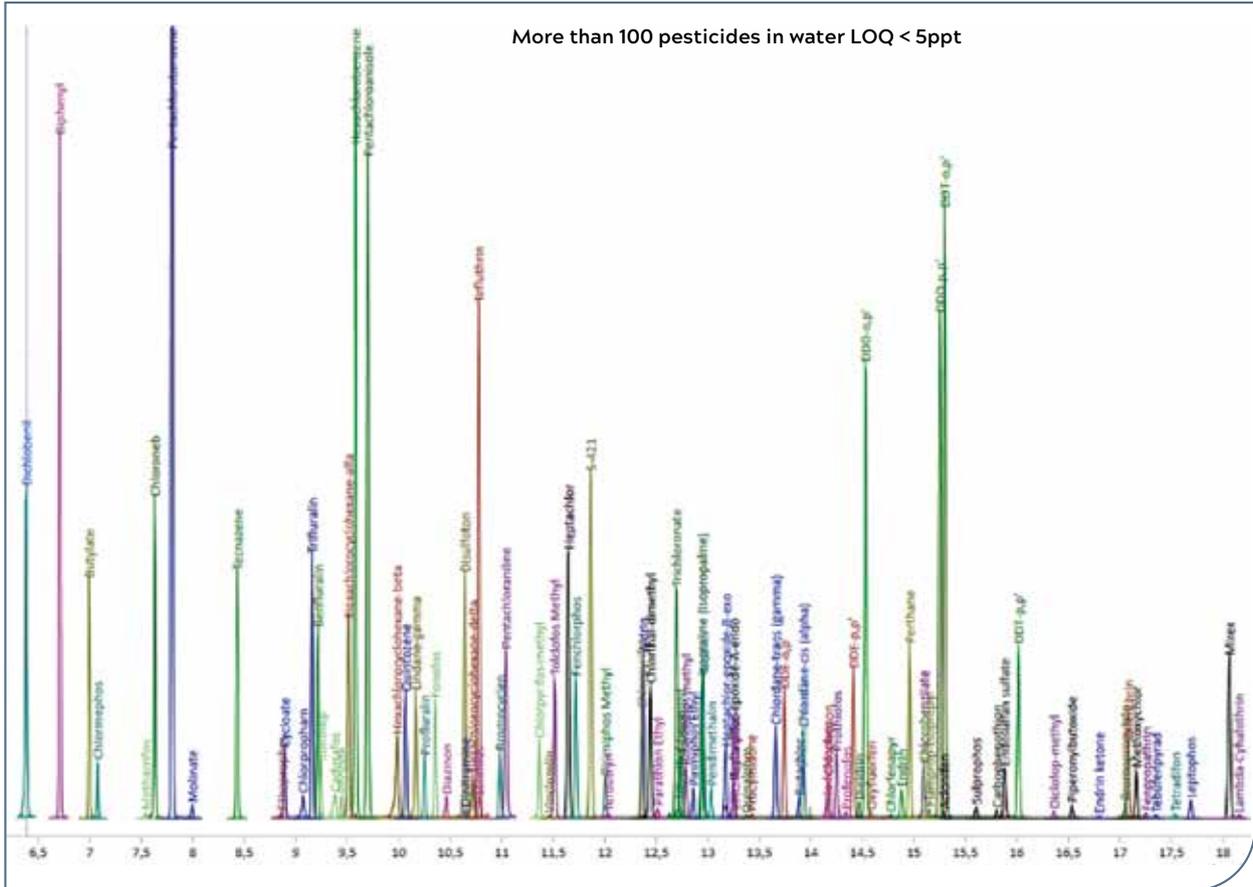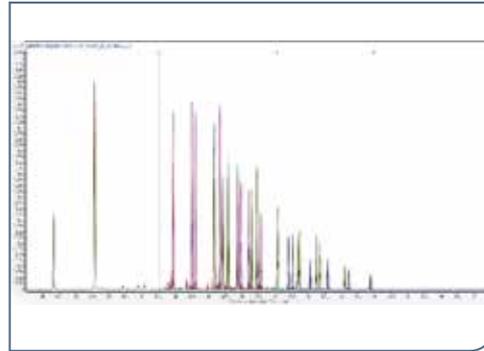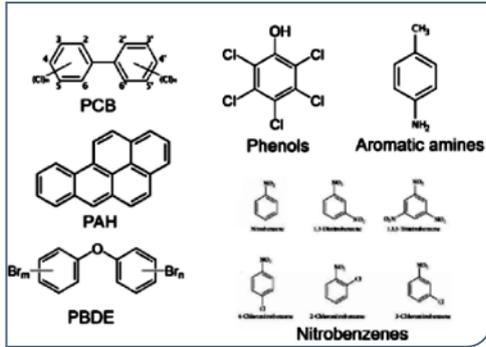
Name	Transition	CF R2	Name	Transition	CF R2	Name	Transition	CF R2	Name	Transition	CF R2
Aclonifen	212.0 -> 182.0	0,999	DDD-o,p'	235.0 -> 165.0	0,997	Fonofos	246.0 -> 109.0	0,998	Pentachlorobenzene	250.0 -> 215.0	0,995
Aldrin	255.0 -> 220.0	0,997	DDD-p,p'	235.0 -> 165.0	0,996	Heptachlor	272.0 -> 237.0	0,999	Perthane	223.0 -> 193.0	0,997
Benfluralin	292.0 -> 264.0	0,998	DDE-o,p'	318.0 -> 176.0	0,996	Heptachlor-epoxide-A-endo	289.0 -> 219.0	0,998	Phorate	260.0 -> 75.0	0,998
Bifenthrin	181.0 -> 165.0	0,994	DDE-p,p'	318.0 -> 176.0	0,997	Heptachlor-epoxide-B-exo	353.0 -> 263.0	0,998	Piperonylbutoxide	176.0 -> 131.0	0,996
Biphenyl	154.0 -> 115.0	0,994	DDT-o,p'	235.0 -> 165.0	0,996	Hexachlorobenzene	284.0 -> 214.0	0,997	Pirimiphos Ethyl	318.0 -> 166.0	0,999
Bromocyclen	359.0 -> 243.0	0,997	DDT-p,p'	235.0 -> 165.0	0,996	Hexachlorocyclohexane-alfa	217.0 -> 181.0	0,997	Pirimiphos Methyl	290.0 -> 125.0	0,999
Bromophos methyl	331.0 -> 286.0	0,997	Diazinon	304.0 -> 179.0	0,996	Hexachlorocyclohexane-beta	217.0 -> 181.0	0,998	Procymidone	283.0 -> 96.0	0,994
Bromopropylate	341.0 -> 183.0	0,997	Dichlobenil	171.0 -> 100.0	0,999	Hexachlorocyclohexane-delta	217.0 -> 181.0	1,000	Profenofos	339.0 -> 269.0	0,993
Butachlor	176.0 -> 146.0	0,997	Dichloran	206.0 -> 176.0	0,991	Iodofenphos	377.0 -> 157.0	0,994	Profluralin	318.0 -> 199.0	0,997
Butylate	156.0 -> 57.0	0,999	Diclofop-methyl	340.0 -> 253.0	0,998	Isodrin	262.8 -> 193.0	0,998	Propham	179.0 ->93.0	0,995
Cadusafos	159.0 -> 97.0	0,994	Dieldrin	277.0 -> 240.8	0,993	Isofenphos	213.0 -> 121.0	0,998	Prothiofos	309.0 -> 239.0	0,998
Carbophenothion	342.0 -> 157.0	0,991	Dinitramine	261.0 -> 195.0	0,997	Isopraline (Isopropaline)	280.0 -> 238.0	0,996	Quinalphos	298.0 -> 156.0	0,992
Chlordane-cis (alpha)	373.0 -> 266.0	0,997	Disulfoton	88.0 -> 60.0	0,999	Lambda-Cyhalothrin	208.0 -> 181.0	0,992	Quintozene	295.0 -> 237.0	0,999
Chlordane-trans (gamma)	373.0 -> 266.0	0,996	Endosulfan alfa	241.0 -> 206.0	0,996	Leptophos	171.0 -> 77.0	0,996	S-421	130.0 -> 95.0	0,997
Chlorfenapyr	247.0 -> 227.0	0,993	Endosulfan beta	241.0 -> 206.0	0,995	Lindane-gamma	219.0 -> 183.0	0,999	Sulfotep	322.0 -> 146.0	0,998
Chlorfenson	302.0 -> 175.0	0,999	Endosulfan sulfate	272.0 -> 237.0	0,999	Methacrifos	208.0 -> 93.0	0,999	Sulprophos	322.0 -> 156.0	0,998
Chlorfenvinphos	267.0 -> 159.0	0,990	Endrin	242.8 -> 173.0	0,999	Methoxychlor	227.0 -> 141.0	0,997	Tebufenpyrad	318.0 -> 145.0	0,991
Chlormephos	234.0 -> 65.0	0,998	Endrin ketone	317.0 -> 101.0	0,992	Mirex	272.0 -> 237.0	0,996	Tecnazene	261.0 -> 203.0	0,999
Chlorobenzilate	251.0 -> 139.0	0,998	Ethoprophos	158.0 -> 97.0	0,991	Molinate	187.0 -> 126.0	0,998	Tefluthrin	177.0 -> 127.0	0,996
Chloroneb	191.0 -> 113.0	0,999	Etrimfos	292.0 -> 181.0	0,994	Nitrothal-isopropyl	236.0 -> 120.0	0,999	Terbuthylazine	214.0 ->104.0	0,99
Chlorpropham	213.0 -> 171.0	0,999	Fenchlorphos	285.0 -> 240.0	0,998	Oxyfluorfen	300.0 -> 223.0	0,998	Terbutryn	241.0 -> 170.0	0,990
Chlorpyrifos	314.0 -> 258.0	0,996	Fenpropathrin	208.0 -> 181.0	0,991	Parathion Ethyl	291.0 -> 109.0	0,992	Tetradifon	354.0 -> 227.0	0,997
Chlorpyrifos-methyl	286.0 -> 93.0	0,997	Fenson	268.0 -> 77.0	0,998	Pendimethalin	252.0 -> 162.0	0,998	Tolclofos Methyl	265.0 -> 93.0	0,998
Chlorthal-dimethyl	301.0 -> 223.0	0,999	Fenvalerate	167.0 -> 125.0	0,991	Pentachloraniline	263.0 -> 192.0	0,998	Trichloronate	297.0 -> 269.0	0,998
Cycloate	154.0 -> 72.0	0,999	Flamprop-Isopropyl	276.0 -> 105.0	0,999	Pentachloroanisole	280.0 -> 237.0	0,998	Trifluralin	306.0 -> 264.0	0,999

Full integration

Oil In water

Petroleum Hydrocarbons C10-C40 determination is a routine analysis that requires challenging LOQ in waters.

The reference method for ISO 9377-2 requires one Liter of sample and more than 50 ml of hexane, not to mention a high amount of Florisil® and sodium sulphate.

Furthermore, the sample preparation requires lot of operator time, as well as carefully cleaned glassware.

The integrated solution **saves up to 90% of hexane, reduces up to 1/50 the sample volume, and requires less than 1/10 of Florisil®**.

The automated process has been finely tuned and involves the extraction using the high mixing power of the **GERSTEL QuickMix** and the sample **centrifugation** to separate the two phases even with foamy samples.

The **decapper** module eliminates the need of

septum piercing during the liquid handling preventing the siloxanes contamination of the extracts.

The GC features a COC injector, and an optimized solvent vapor exit setup to allow the **injection of up to 500uL to gain LOQ of <25ppb**.

The overall repeatability and recoveries, as well as the method performances, overshoots the ISO 9377-2 requirements allowing robust and unattended operation.
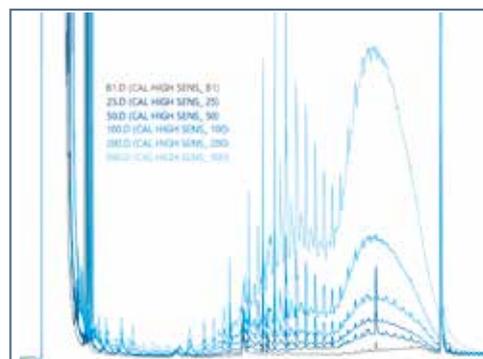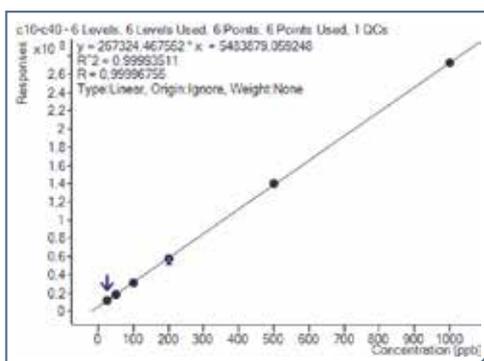
MOSH-MOAH
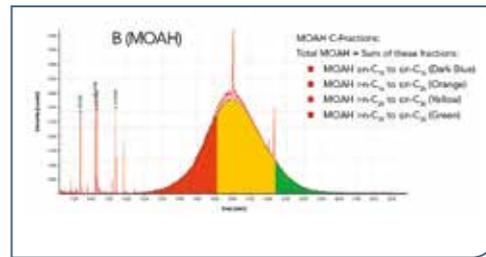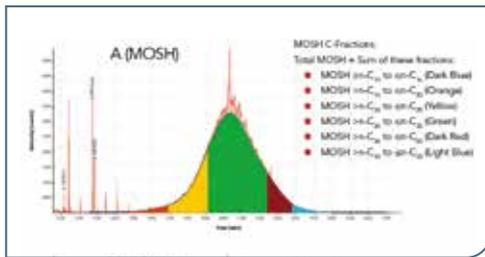
Mineral oil saturated hydrocarbons (**MOSH**) and mineral oil aromatic hydrocarbons (**MOAH**) are emerging high concern pollutant. According to the DIN EN 16995:2017-08 the MOSH and MOAH fractions are separated with an HPLC, the two fractions are then quantified with a GC-FID.

SRA and GERSTEL were in the front line pioneering the first commercial solutions for the automation of the MOSH/MOAH determination; over the years the technology and the available features have evolved along with the know-how to the current state of art.
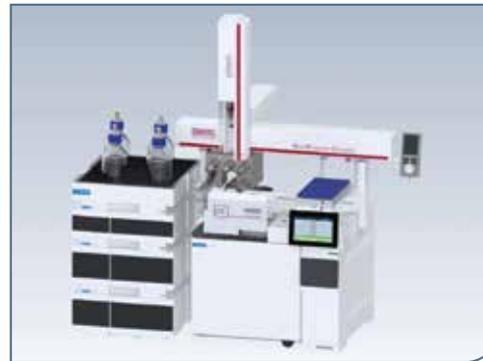

The system is based on a coupled HPLC-GC/FID system using the GERSTEL MultiPurpose Sampler (MPS).

The platform **fully automates the sample preparation and GC introduction**:

- SAPONIFICATION, EPOXIDATION and ALOX cleanup can be included.

In case of high variable matrices or to improve the productivity EPOXIDATION and SAPONIFI-CATION can be performed with a dedicated "off-line" platform limiting the HPLC-GC/FID to the MOSH MOAH separation, ALOX cleanup and GC quantification.
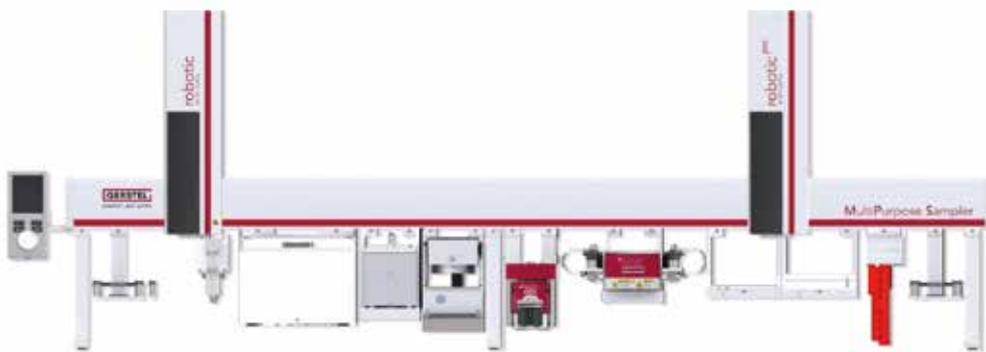
INANOIL

Current EU legislation provides objective criteria aimed at classifying the various types of olive oils (virgin, clear, refined, etc.). These criteria are listed in the EEC regulation No. 2104-2105/2022.

Assigning each oil to the correct class is crucial to guarantee the correct commercialization of olive oils complying with the characteristics declared on the label, avoid potential adulteration, ultimately protect the health and interests of the final consumer.

The regulation defines the analytical methods relating to the quantification of:

1. **alkyl esters and waxes**
2. **sterols, triterpene dialcohols and aliphatic alcohols**
3. **stigmastadienes**
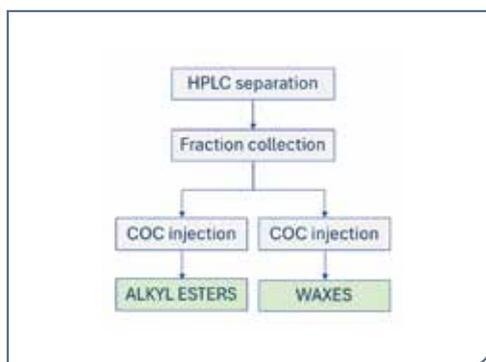
All these methods involve laborious sample preparation, large quantities of solvents and consumables, the use of qualified operators for a long time.

The robotic stations are able to fully automate the sample-prep and the subsequent GC analysis dramatically reduces the manual workload and possibility of random errors, keeping the process under control with high productivity and reliability with no compromises in terms of precision and accuracy.

1. alkyl esters and waxes

Off-line preparative techniques (LC, LLE) are replaced with an automated separation of the fractions of interest via HPLC,

The fine optimization of the chromatographic parameters makes the elution times of methyl/ethyl esters and waxes extremely repeatable.

The withdrawal of this fraction and the subsequent injection in LVI-COC-FID immediately provides the analytical data, limiting the operator's intervention to the simple start of the analysis sequence.

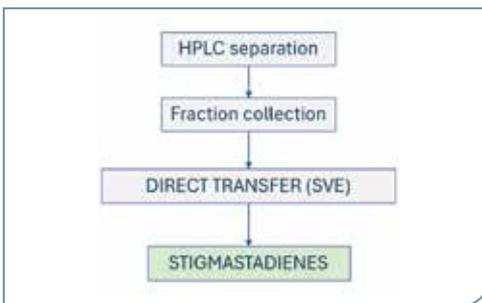## 2. sterols, triterpenes dialcohols and aliphatic alcohols
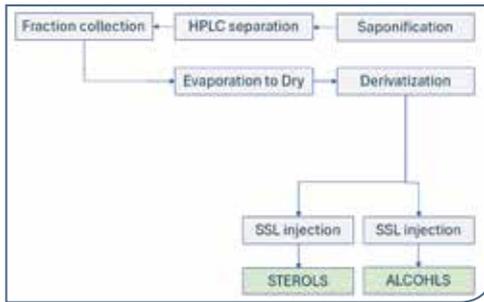
Off-line preparative techniques (LC, TLC, LLE) are replaced with an automated separation of the fractions of interest via HPLC .

The accurate optimization of the chromatographic parameters makes the elution times of the various classes (aliphatic alcohols and sterols / triterpene dialcohols) reproducible allowing a robust fraction collection.

The versatility of the MPS RoboticPRO platforms also allows you to extend the automation of the workflow by including the necessary steps of evaporation to dryness and recovery with derivatizer. The subsequent injection in SSL-FID mode immediately provides the analytical data, limiting the operator's intervention to the simple start of the analysis sequence.

3. stigmastadienes

Off-line preparative techniques (LC, LLE) are replaced with an automated separation of the fractions of interest via HPLC. This analytical approach also allows to eliminate the saponification step.

The optimization of the chromatographic parameters allow a reliable separation of the stigmasta-

dienes from the squalene interference.

The fraction of interest is directly routed to the GC injection port.

The stigmastadienes determination is applicable on the same hardware used for the MOSH-MOAH automation extending the system versatility.

Analytical performance

A series of experimental tests were carried out using a virgin reference oil as control sample, whose content is certified by the interlaboratory circuit of the Bari Chamber of Commerce - Ring

Test. N. 62 (RT62).

The result of the validation batch on a series of 10 repetitions, highlights the absolute reliability of the data in terms of accuracy and precision.

Waxes validation		Alkylesters validation		Stigma RT62 validation	
Reference value (as per RT62) waxes= 221.0 mg/Kg		Reference value (as per RT62) FAEE = 36.2 mg/Kg		Reference value (as per RT62) Stigma = 3.70 mg/Kg	
BIAS = 0.25 %	CV,%= 2.32%	BIAS = 2.18%	CV,% = 1.51%	BIAS = 1.66%	CV,% = 1.16%
Alifatics alcohols validation		Sterols and e Triterpenic Dialcohols validation		Stigma cut-off validation	
Reference value (as per RT62) alcohols = 258.7 mg/Kg		Reference value (as per RT62) Sterols = 1447 mg/Kg		Reference value (as per RT62 dil 1/65) Stigma = 0.057 mg/Kg	
BIAS = 1.46%	CV,% = 1.53%	BIAS = 1.73%	CV,% = 1.74%	BIAS = 6.03%	CV,% = 6.48%

With the multisectoral expertise and a legacy of more than 25 years SRA Instruments is the perfect partner to automate any laboratory workflow with progressive tailor-made approach.

Some specific bottlenecks can be assisted with high-end solutions increasing the overall quality, throughput and efficiency of the daily routine, or the entire analytical process can be performed onto one unique platform integrating the sample preparation with the analytical systems.

*This information is subject to change
  without notice.

SRA
INSTRUMENTS
ANALYTICAL SOLUTIONS

Agilent Technologies
Premier Solution Partner

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