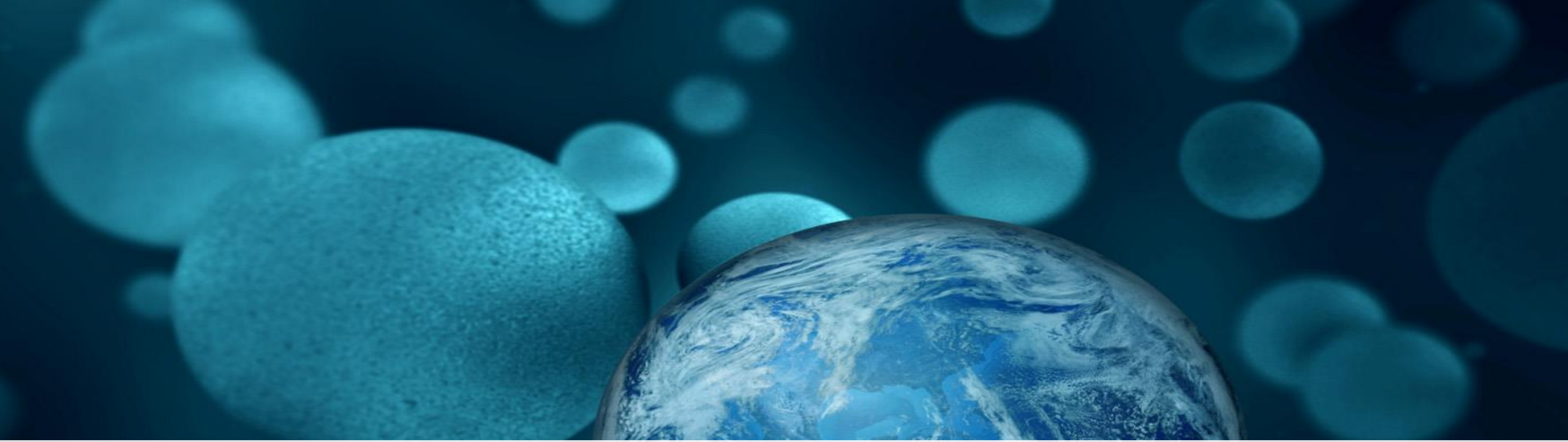
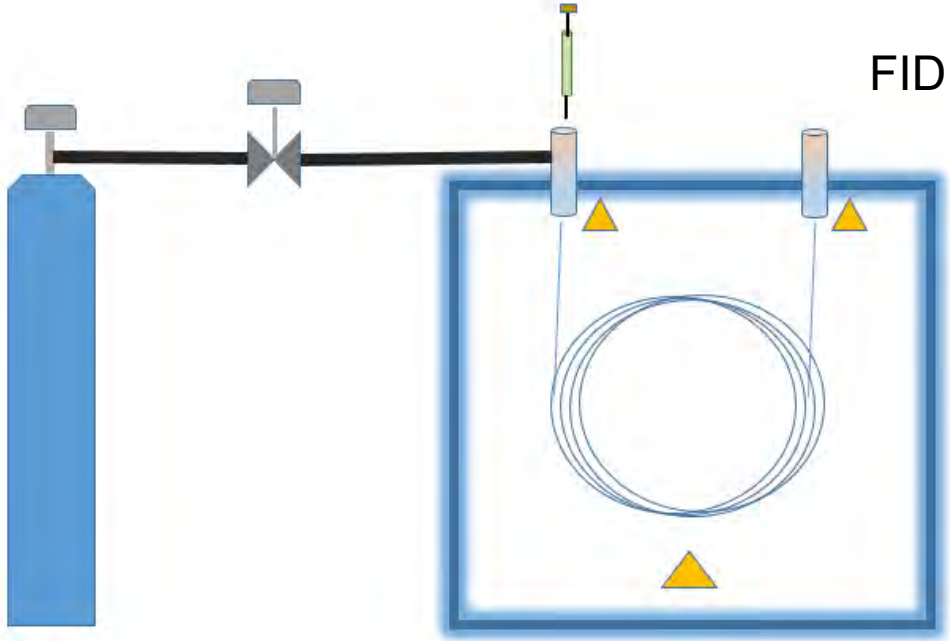


ThermoFisher SCIENTIFIC

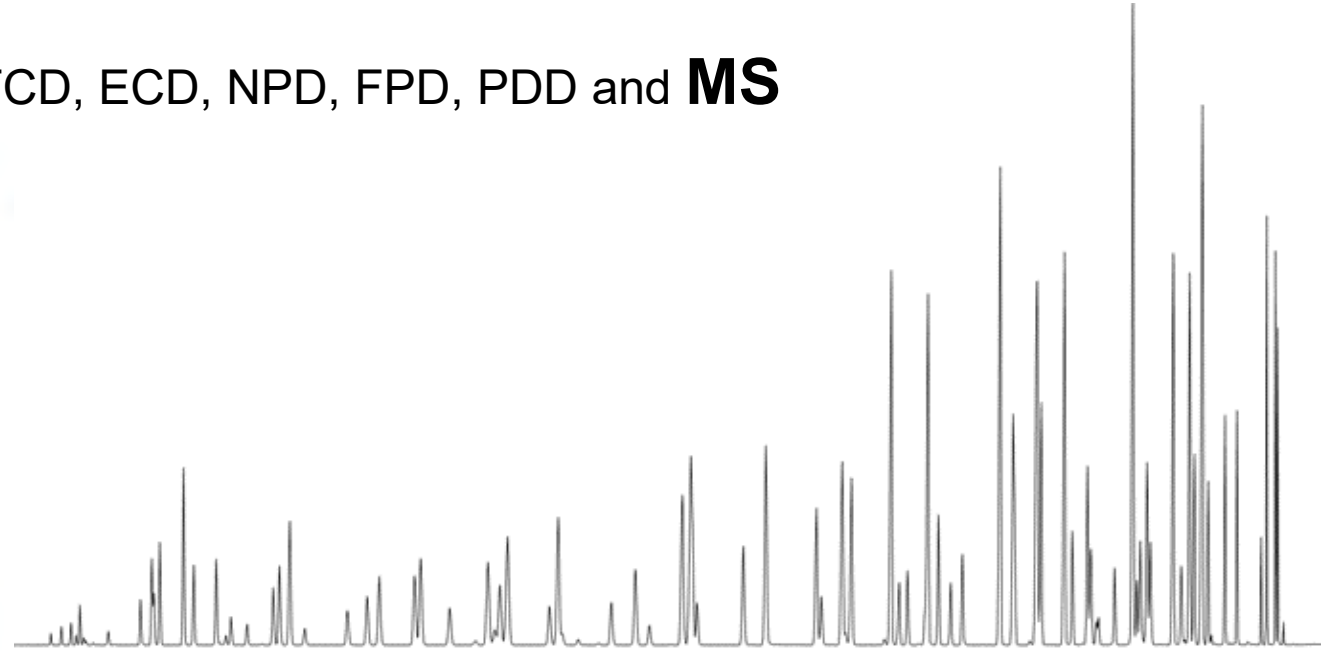
New technology of GCMS

Basic of Gas chromatography

- Gas Chromatography (GC) : Chromatography technique which gas is used as mobile phase
- Sample will be injected into the system, Injection port where all components are vaporized and swept into the column
- Sample components will then be separated according to the interaction with stationary phase and eluted to detector.

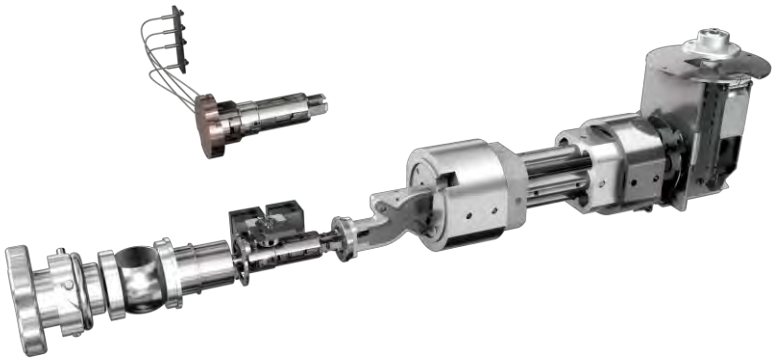


FID, TCD, ECD, NPD, FPD, PDD and **MS**



Why GC/MS?

- Universal and specific
  - ✓ Full scan for unknown sample
  - ✓ SIM, MIM for specific (interested) mass
- High Sensitivity
  - ✓ ppt level
- Provides identification with standard or library spectrum
- Interference-free quantitation (SIM or MIM)
- Isotopic information
- Confirmation of other conventional detectors

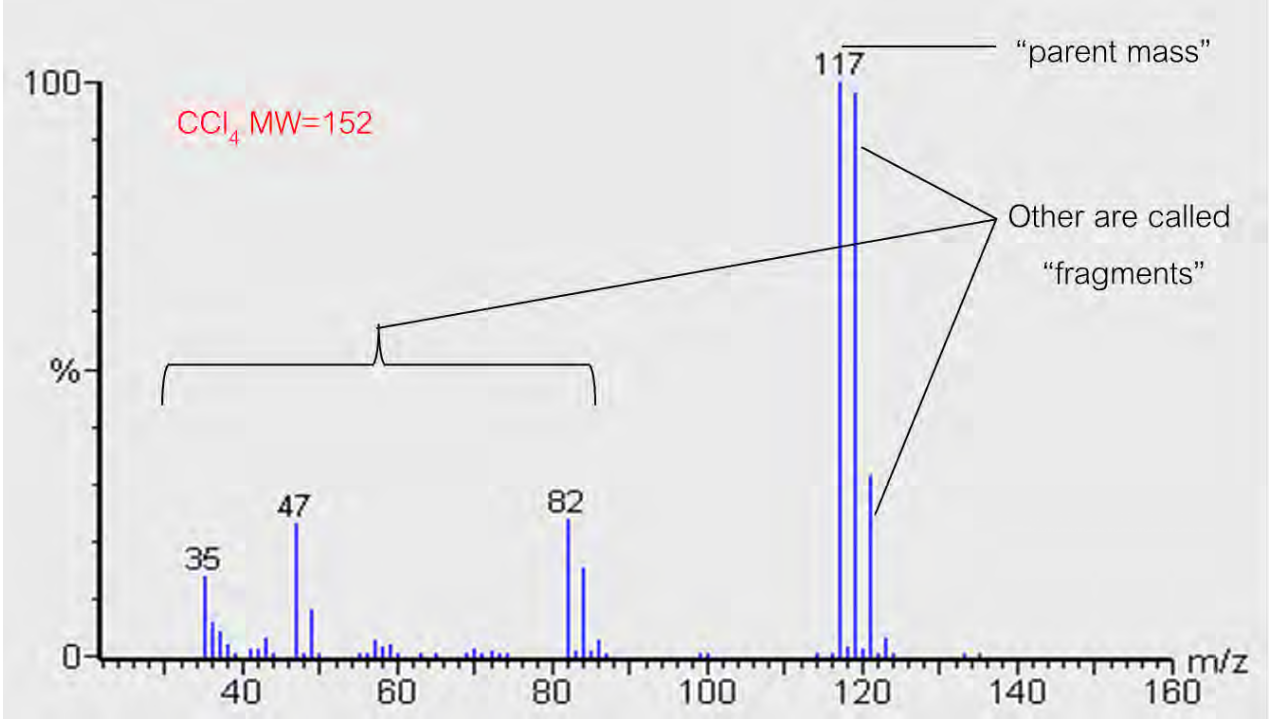


thermo scientific

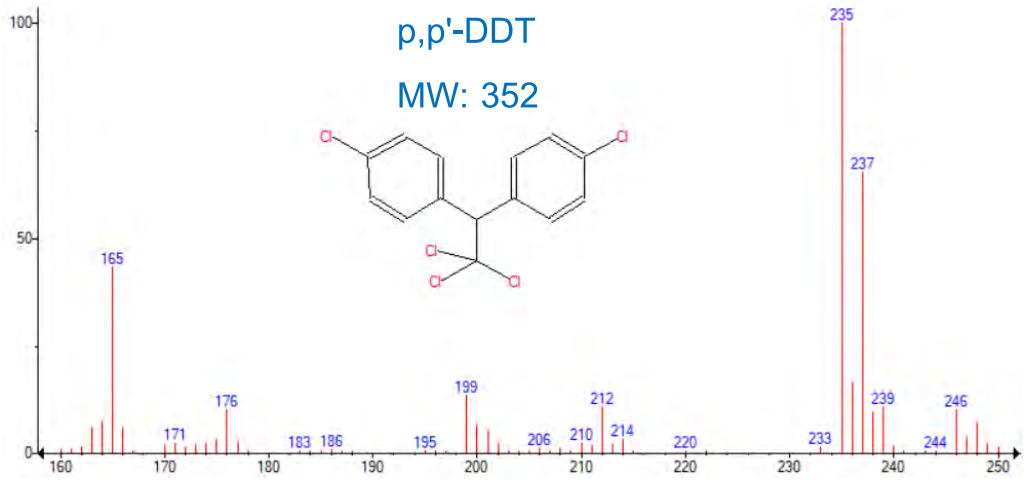
Sci Spec

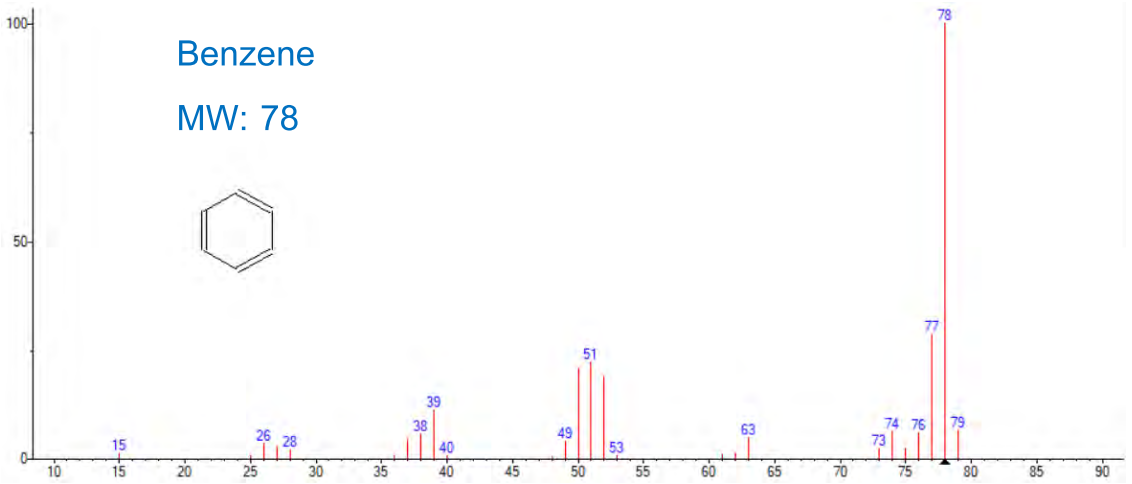
What is Mass Spectrometry?

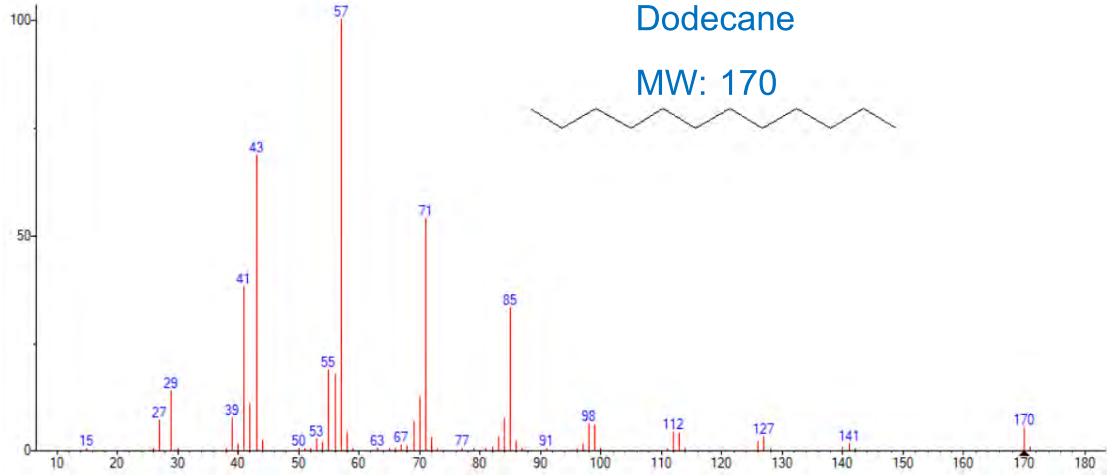
- The production of ions that are subsequently separated or filtered according to their mass-to-charge (m/z) ratio and detected.
- The resulting mass spectrum is a plot of the (relative) abundance of the produced ions as a function of the m/z ratio."

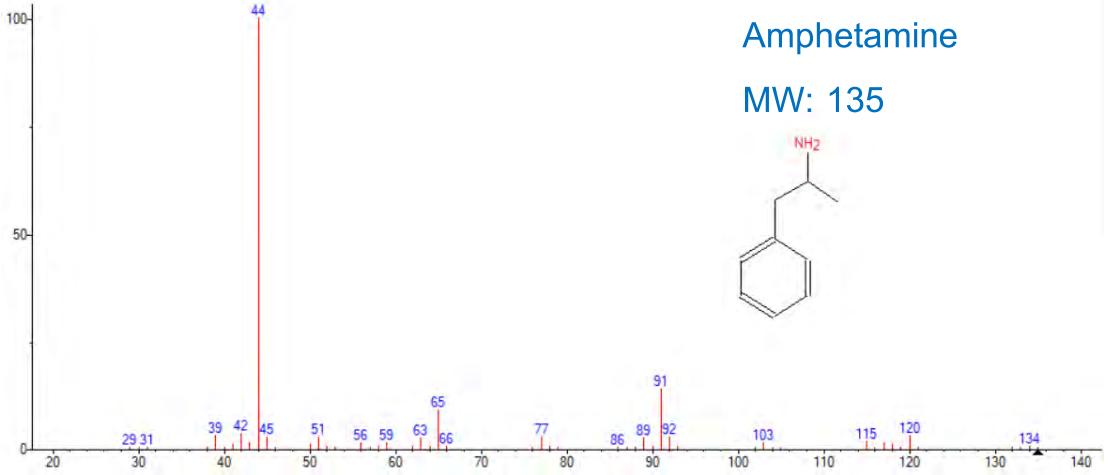


Mass Spectrum





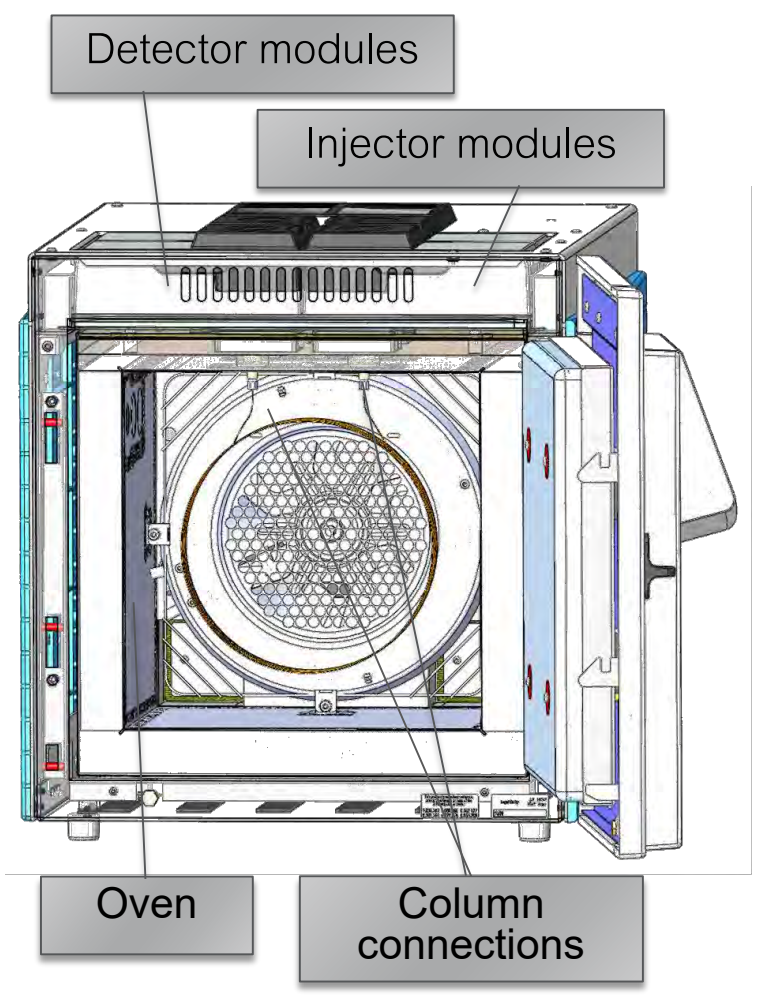




Trace1300 Series GC features to boost productivity and laboratory efficiency

- Capillary iConnect Injector Modules
  - SSL, PTV, On-Column
- Integrated Backflush
  - iConnect SSL and PTV injectors module with integrated BKF capabilities
- Large Volume Injection capablilities
  - With PTV and SSL injector
- iConnect Helium Saver module
  - Proprietary solution to save Helium consumption during operation
- iConnect Detector Modules
  - FID, TCD, ECD, NPD, FPD, PDD
- Retention Time Alignment
  - Easy and quick approach to keep data consistency
- No-vent Module (for NOVPI MS systems)
  - In GCMS operation, it allows to disconnect the column without venting the MS

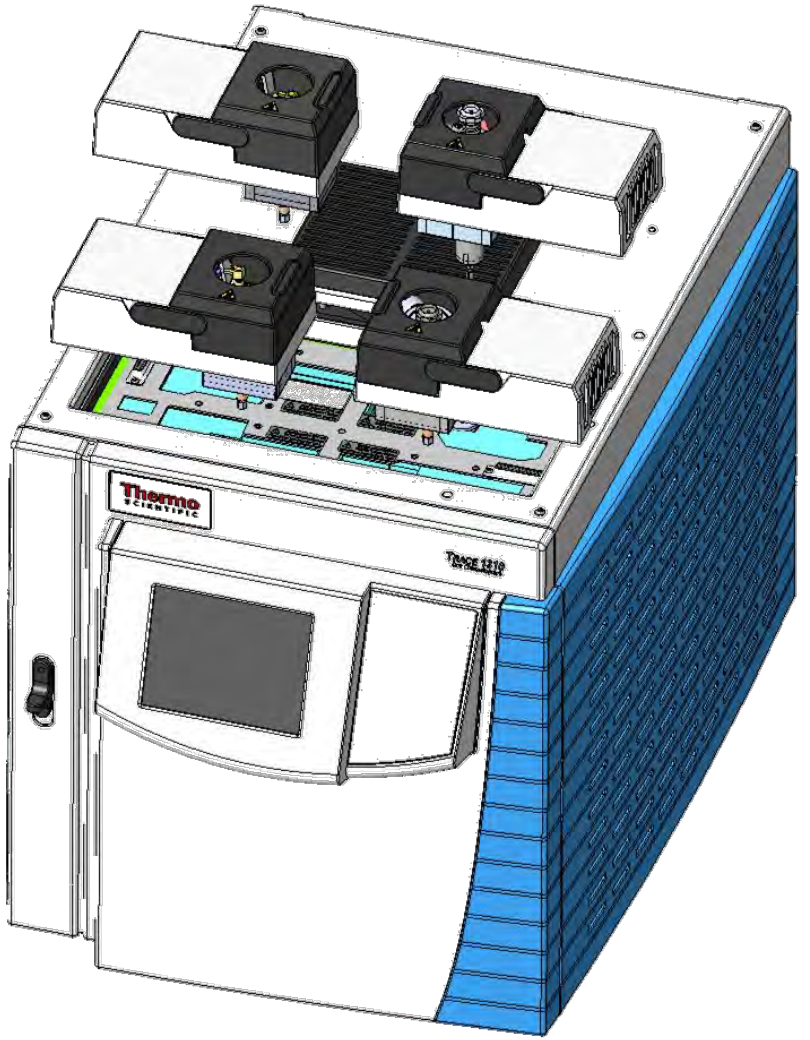
A New Modular GC System



- Inj/det modules fit on the oven top and enter the oven with column connection terminals
- Gas and electrical connections are provided on the top deck base
- User- exchangeable modules in two minutes:
  - Tailor configuration to applications
  - Upgrade systems to ensure productivity growth
  - Inlets: SSL; SSL with Backflush; PTV; PTV with Backflush
  - Detectors: FID; TCD; ECD; NPD

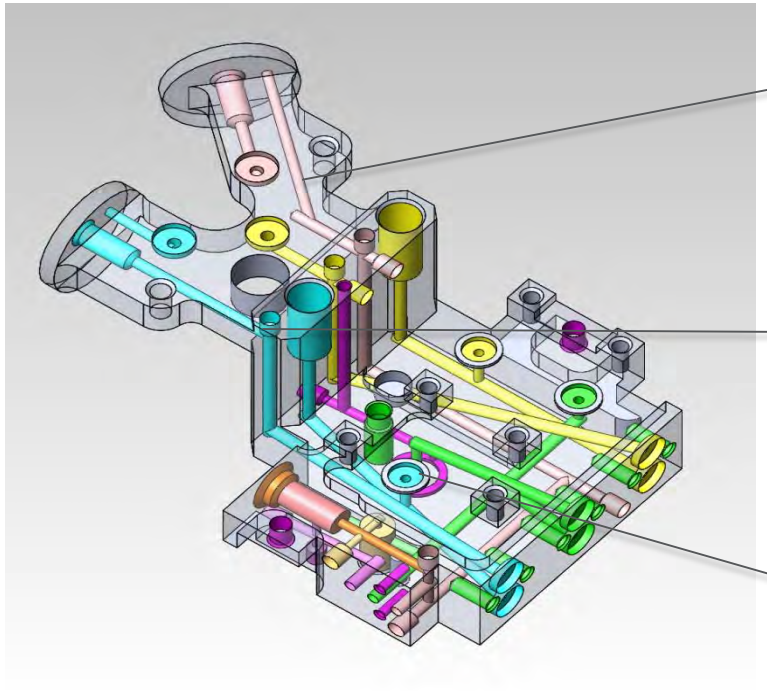
Modular GC: Main Design Challenges

- Miniaturization of components
  - ✓ Miniaturization of electronics board
  - ✓ Miniaturization of pneumatic circuits and components
- Temperature constrains
  - ✓ Housing modules with electronics on an oven running up to 450° C
  - ✓ Compact modules with electronics and with high temperature injector and detector bodies
- Ensuring reliable connections
  - ✓ Gas connections
  - ✓ Electrical connections



Miniaturized Injectors / Detectors Manifolds

- All pneumatic circuit is integrated in the manifold allowing miniaturization.
- No or minimum use of tubing or fittings minimizing risks of leaks.



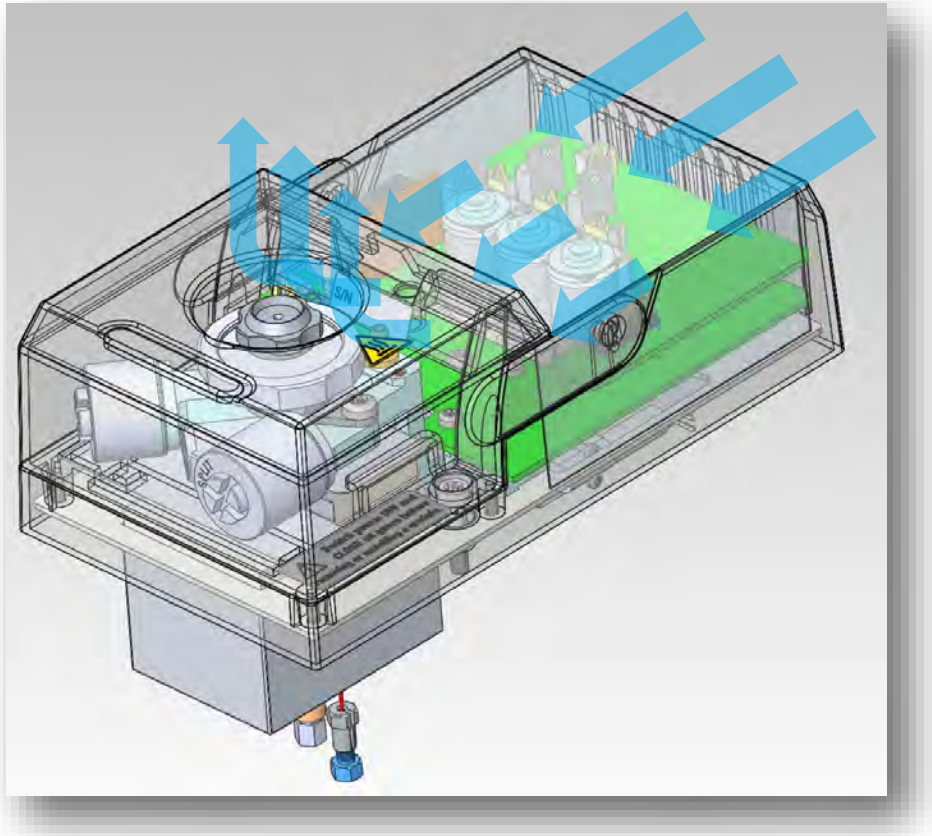
All gas channels are machined into the manifold

Flow restrictors are housed directly into the manifold. Manifold temperature is measured in real time and used for proper flow compensation

Seal to valve and sensor is made by high quality o-rings

SSL Injector Module Active Cooling

- Forced air enters the module from its back side and keep electronics cool
- Air is then vented through the injector box hole creating a barrier against the heat produced by the hot injector
- The air vent helps in keeping the septum head cool without affecting the internal inlet temperature profile
- Module base is cooled by the cold oven top deck copper plate
- Same air path is used for detectors



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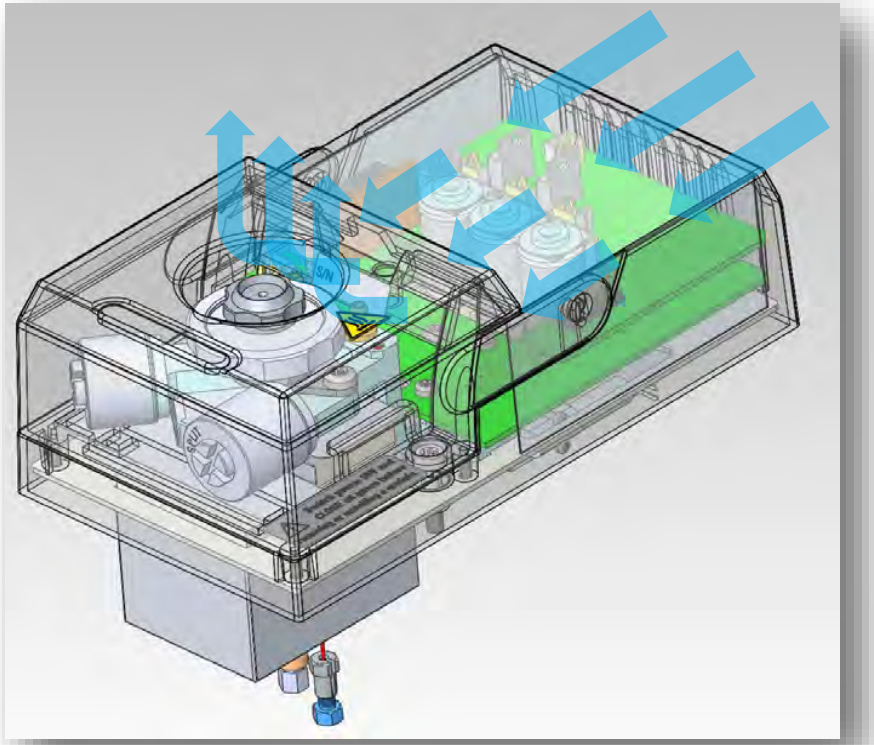
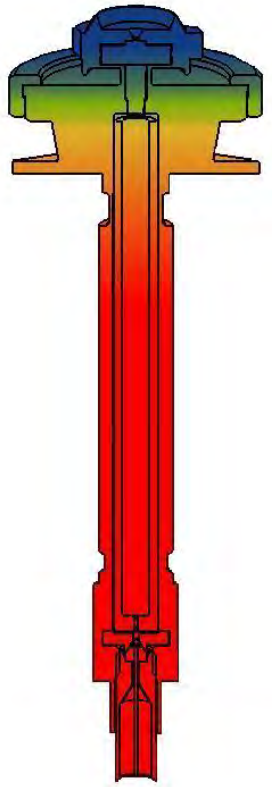
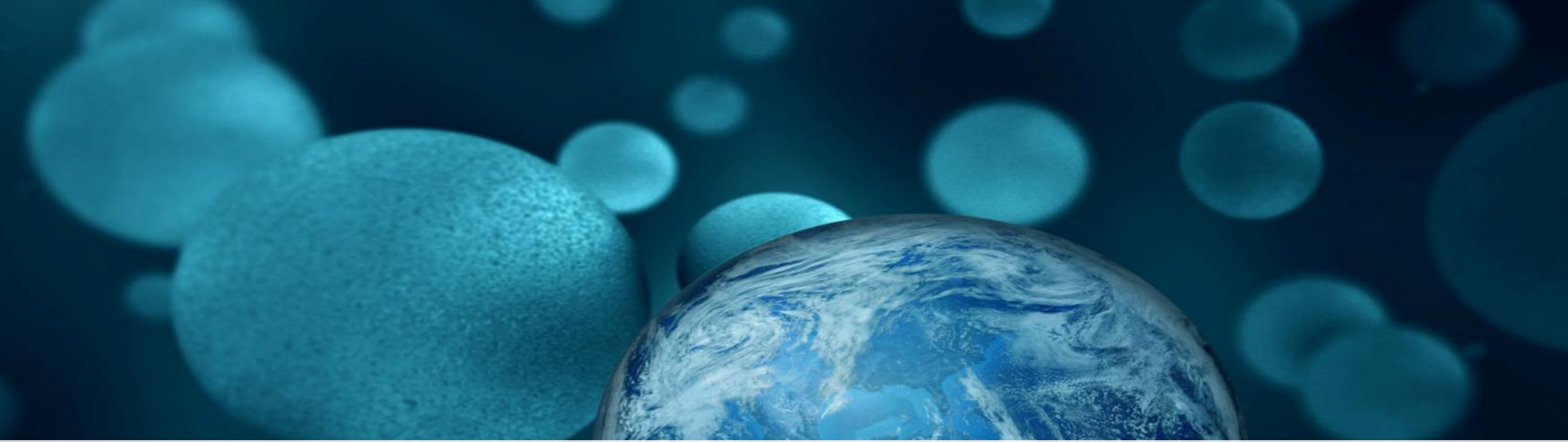




Backflush: built-in for iC-SSL and iC-PTV

- Injector can operate as standard SSL and PTV or reversing the carrier gas flow direction in the inlet, venting from the split line possible "undesired" analytes.
- SSL/PTV BKF can be used as a standard inlets just capping the BKF line

- Back-flush option included in the module without additional plumbing
- Self adjusted carrier flow during backflush for easier operation and method set up
- No need for additional auxiliary gas for backflush operation



ThermoFisher SCIENTIFIC

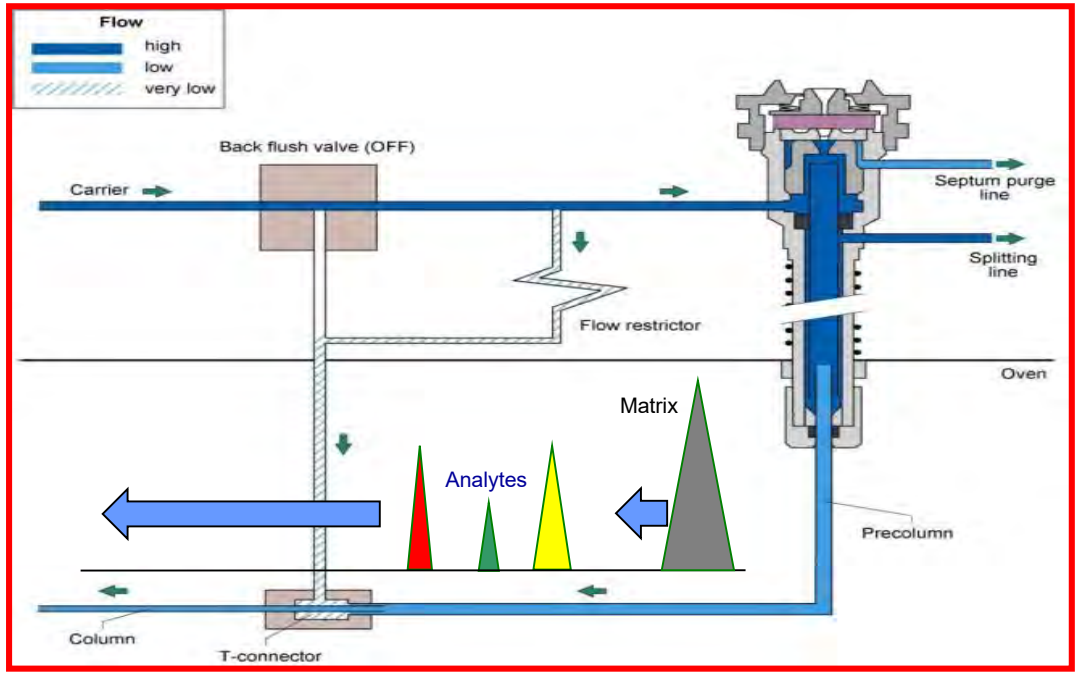
Instant connect SSL and PTV injector with Backflush

Backflush Option : Integrated Solution with PTV and SSL

- Instant connect SSL and PTV injector with backflush capabilities to shorten analysis time and keep the analytical column and the detector cleaner
- Entire pneumatic circuit is integrated in the injector module for a self adjusted carrier flow rate during BKF
- No tubing nor fittings are used, minimizing risks of leaks and method complexity
- Very useful for dirty samples (poor clean-up) (i.e. biological/food extracts)

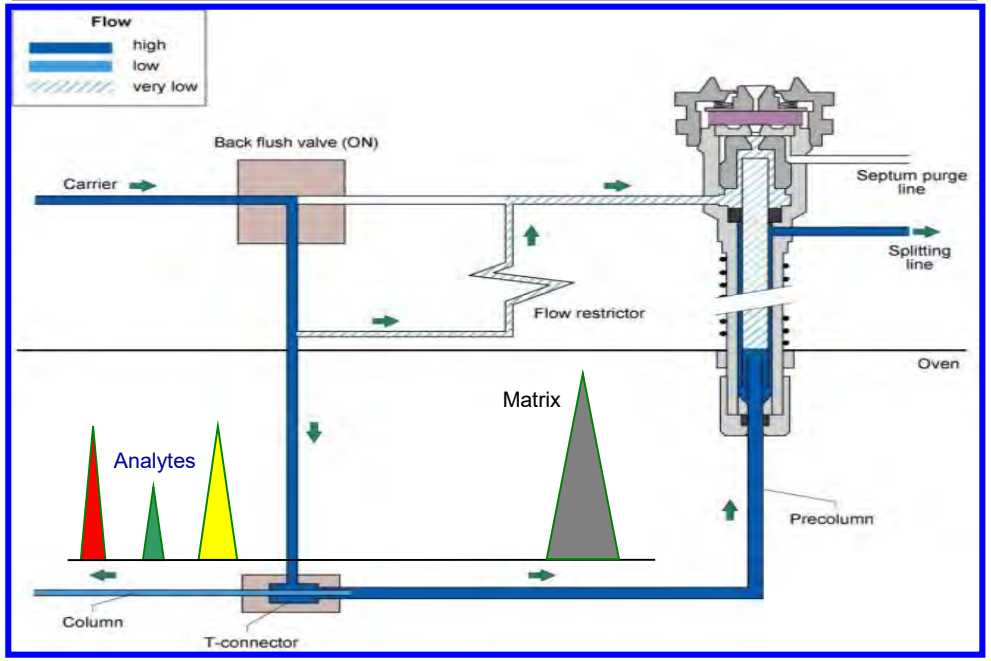
Injection

Transfer to Pre-column and Analytical Column



Backflush

Clean Pre-column and Injector during Analysis Run



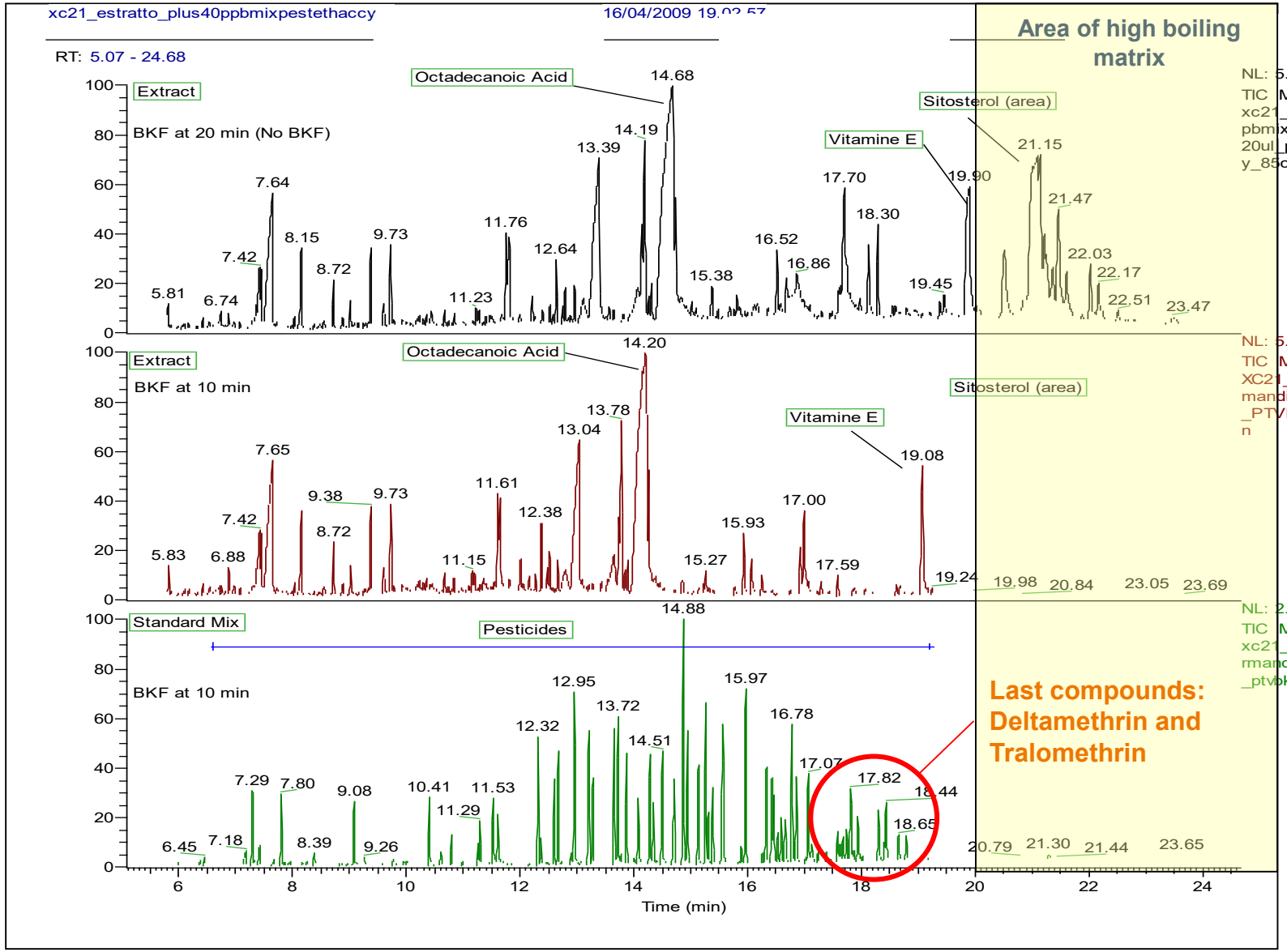
Shorten the analysis time and preserve from matrix contamination

Pear Extracted with Ethyl Acetate

- No Backflush

- With Backflush
  - Transfer time 10 min

- Pesticide standard w BKF
  - Transfer time 10 min



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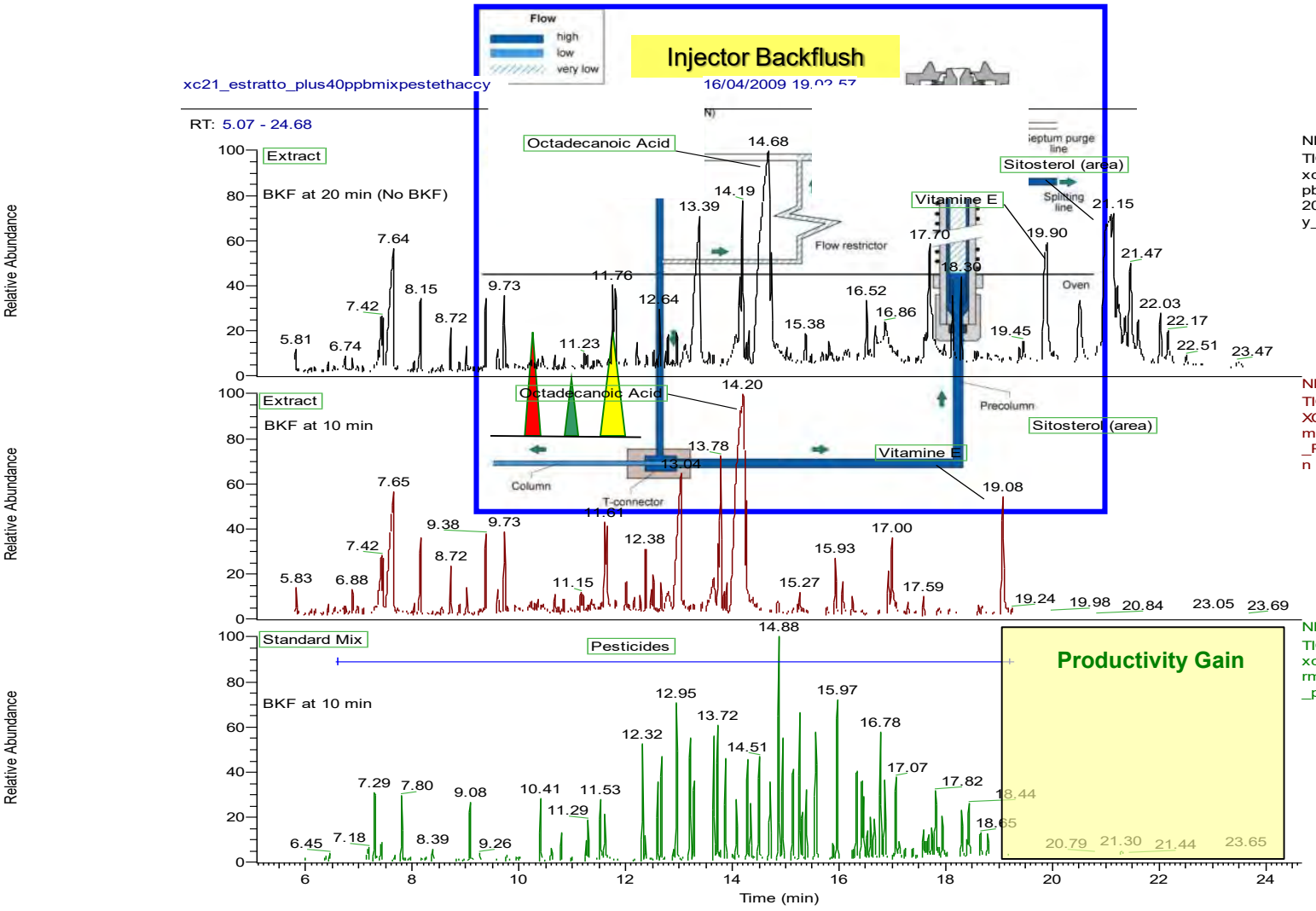
SciSpec

Benefits - Injector Backflush Increases Productivity

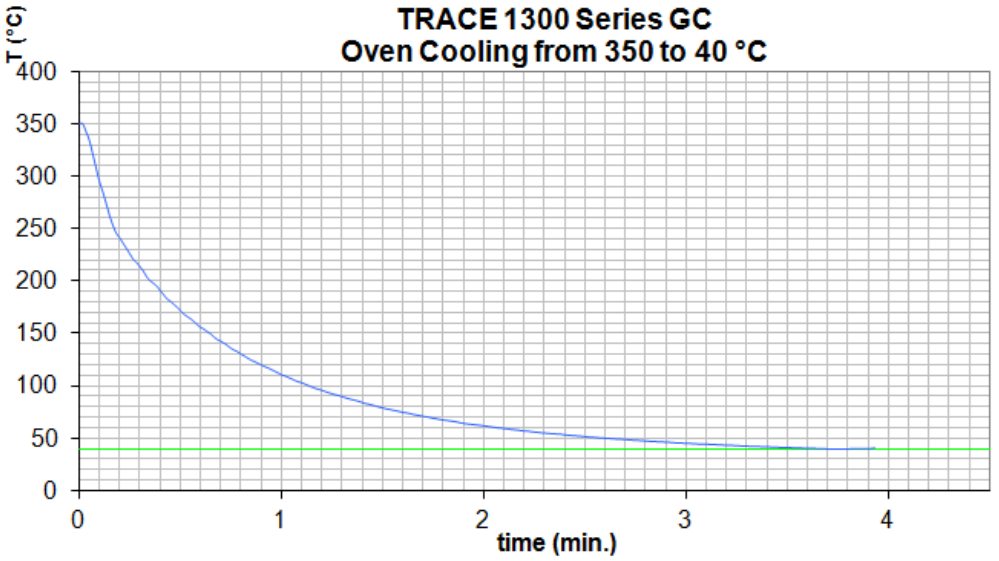
- **Reduce sample prep procedure**
  - for multi-component methods
  - e.g. QuEChERS for pesticides
- **Use concurrent injector backflush**
  - Keep high boiling matrix from the column
  - No need to backflush the whole column
  - Avoid additional clean time after the run
  - Clean the injector as well during the run
  - No need of additional Aux Gas Control
- **Stop the run**
  - After the last compound of interest
  - Get to the next injection
  - Increase sample throughput



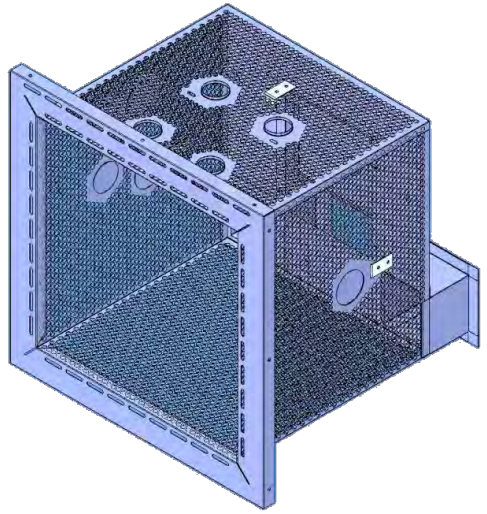
TRACE 1300 series: “1000-holes” capabilities

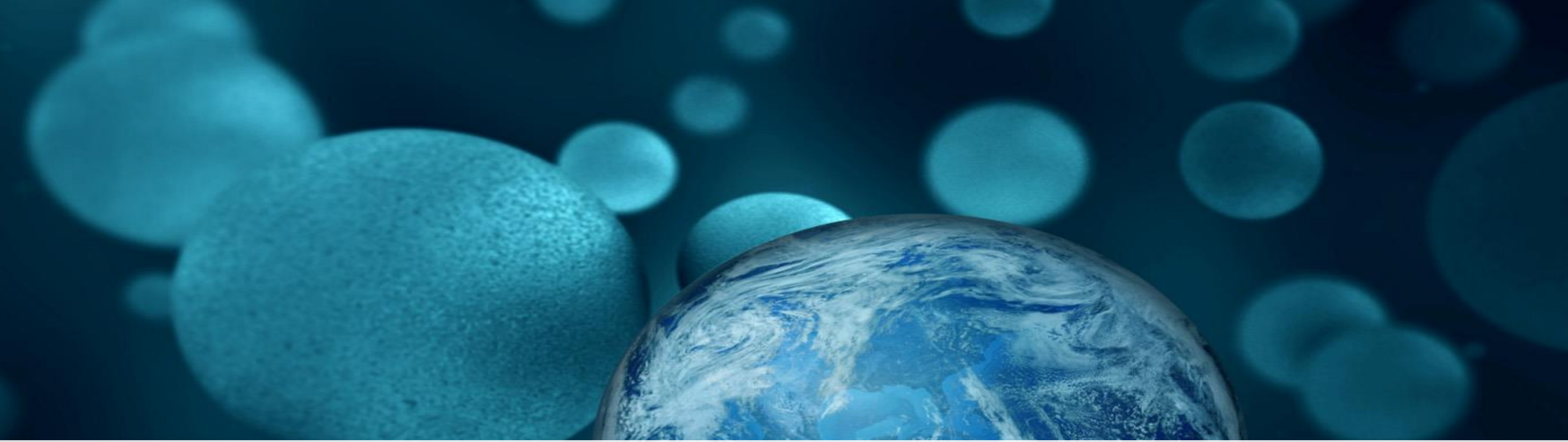
- Quickly recover starting conditions after power off

Warm-up times. From OFF conditions to readiness (minutes)		
	TRACE 1300 Series	Brand A
Oven at 50 °C INJ & DET at 250°C	3.5	10.2



- Fast Heating and cooling
- Quickly reaching starting temperature of ambient +3°C
- Cooling from 450 to 50°C in < 4’
- Cooling from 350 to 40°C in < 3.5’





ThermoFisher SCIENTIFIC

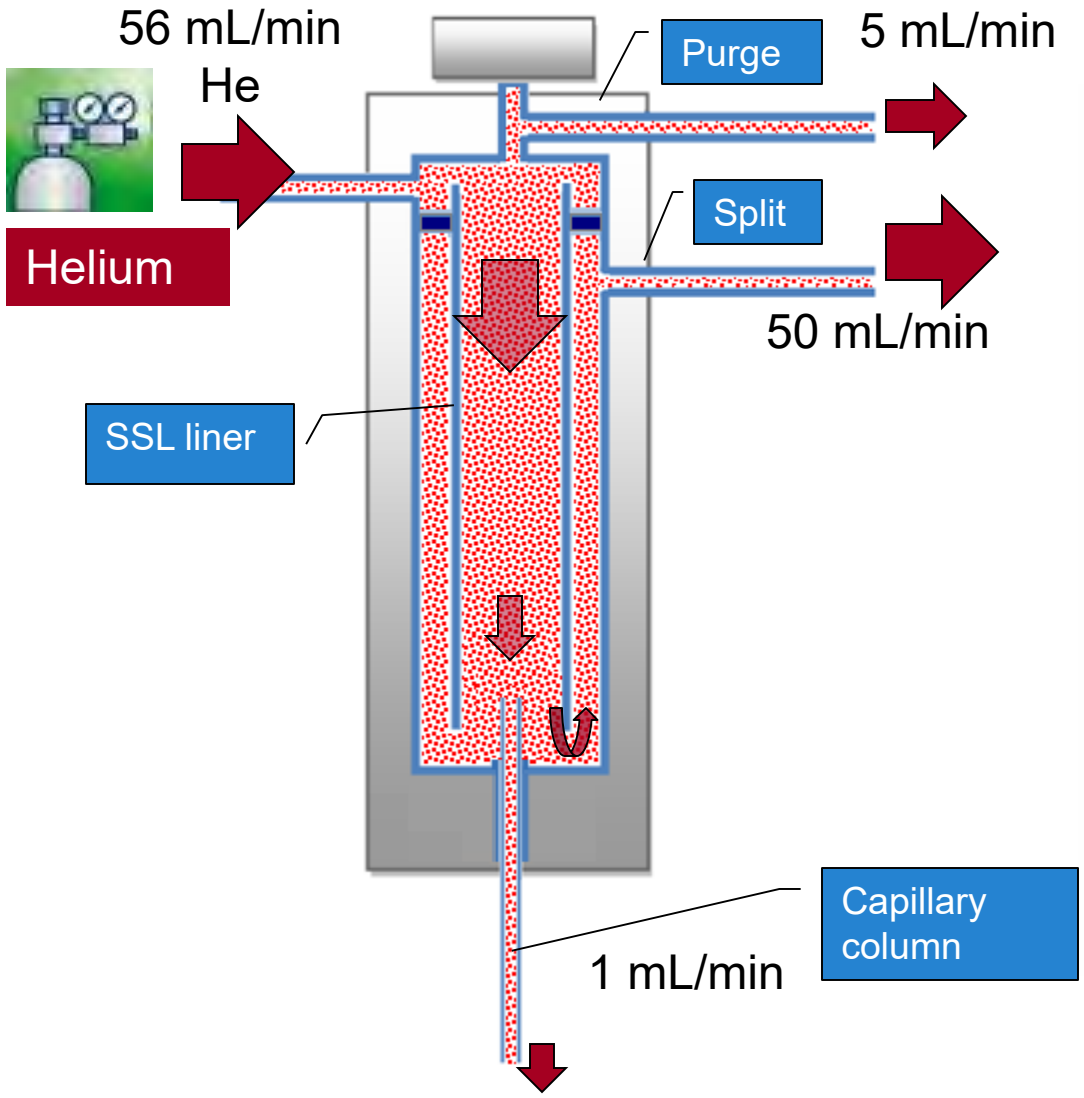
Instant Connect Helium Saver

Reducing Helium Consumption

- There are some practical advantages in reducing Helium consumption versus migrating to a different carrier gas
  - There is no need to revalidate methods
  - There are no safety concerns when using Helium in the GC oven
  - There are no concerns about possible negative impact on detector performance (e.g. MS)

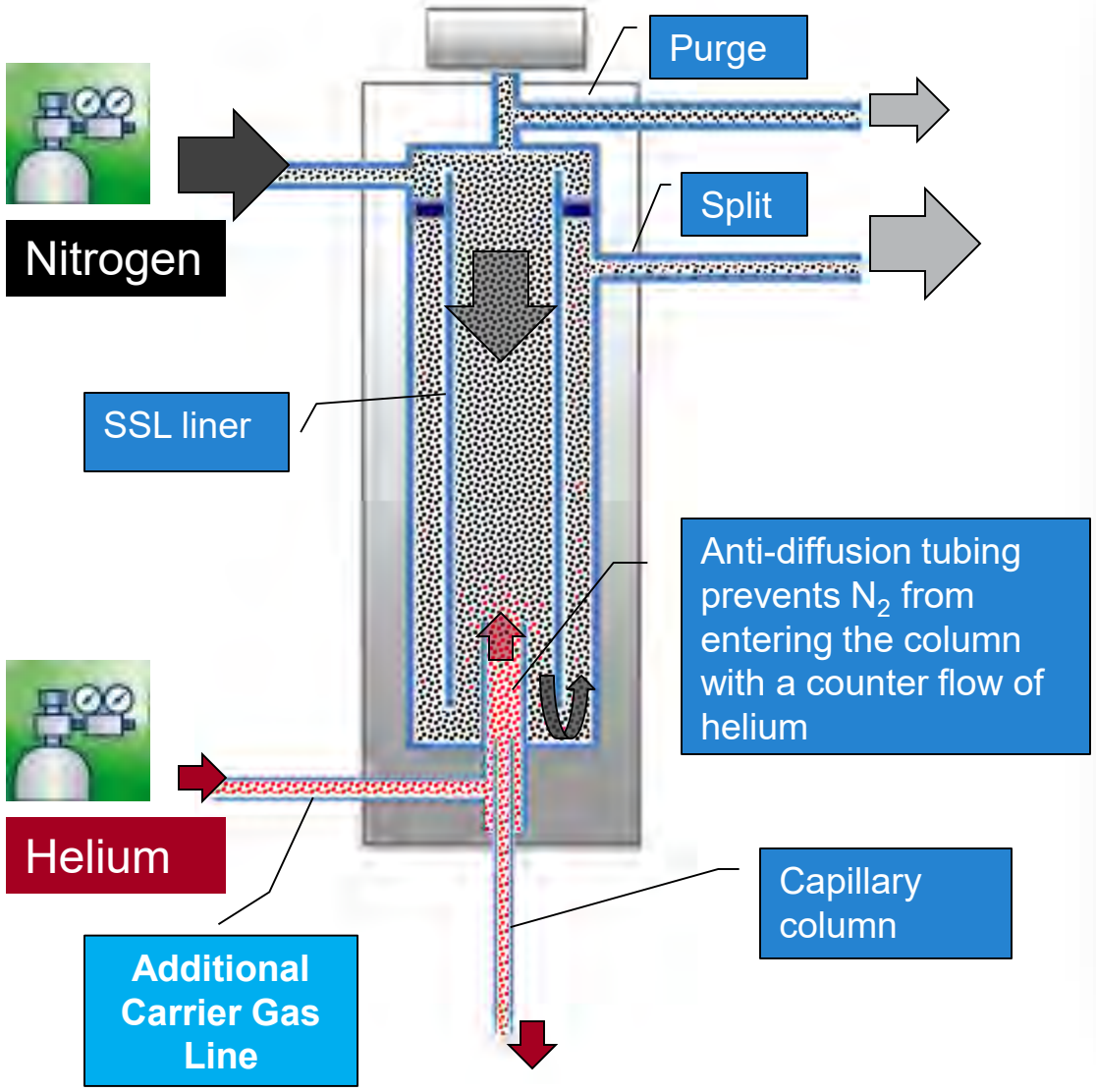
- The instant connect helium saver injector is using simultaneously two different gasses
  - Helium carrier gas is only used for separation process
  - A different gas is used to purge the inlet and split sample (e.g. Nitrogen)

Standard Split/Splitless Injector



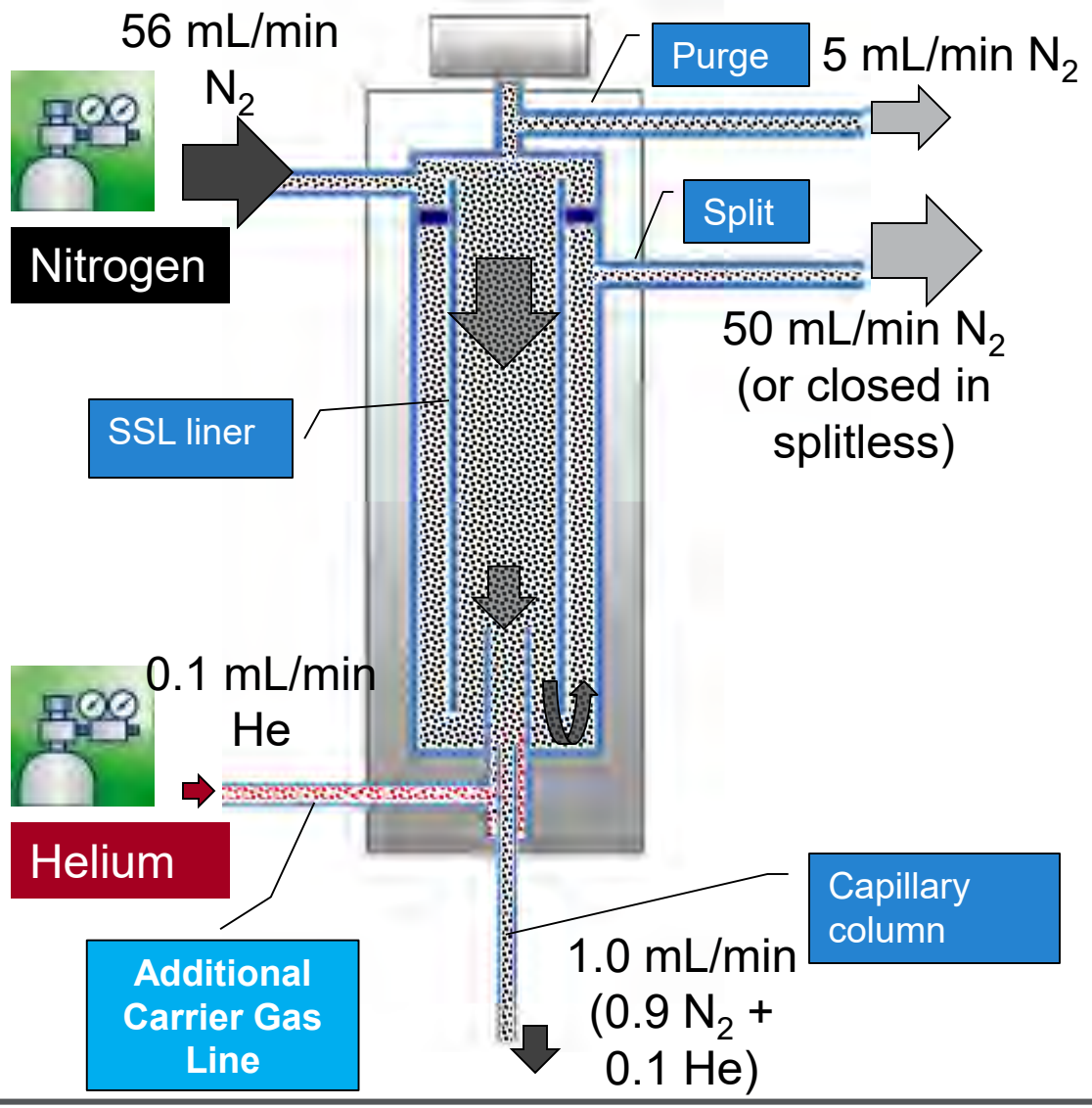
- SSL design almost unchanged since the introduction of capillary columns
- Same gas used for separation carrier, septum/inlet purge and sample splitting
- Typically only ~1/10 - 1/50 of the total flow enters the column
- Purge and split flows cannot be reduced beyond a certain limit without introducing contamination into column/detector:
  - Sample matrix accumulated in liner and lines
  - Septa particles
  - Air diffusing from septa
  - Seals outgassing

Instant Connect Helium Saver Module



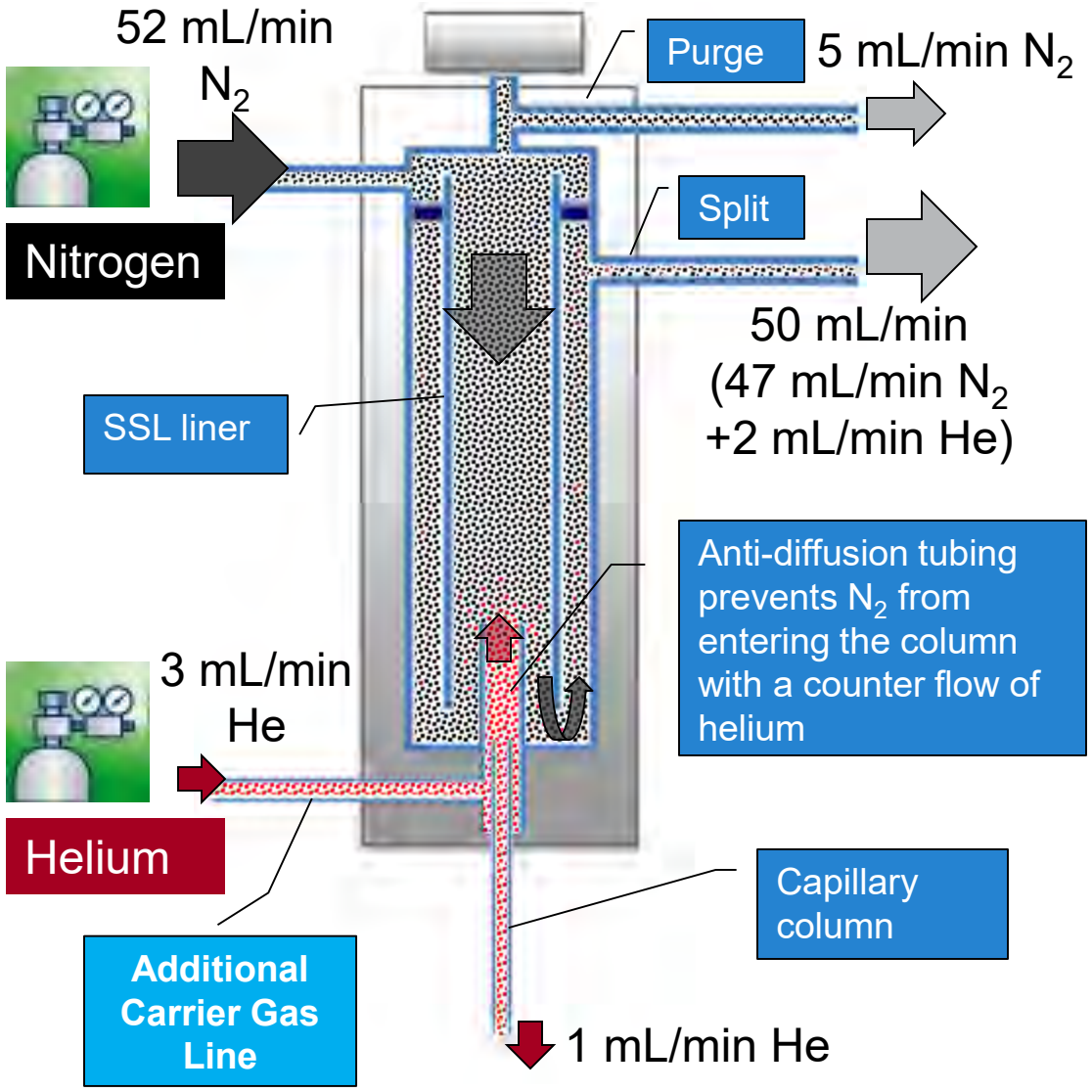
- Inlet supplied with 2 gases
- **Nitrogen** column head pressure settings regulates **Helium** flow
- The additional Helium line doesn't need active regulation and gas can be supplied using calibrated restrictor

How the Helium Saver Module Works: Injection

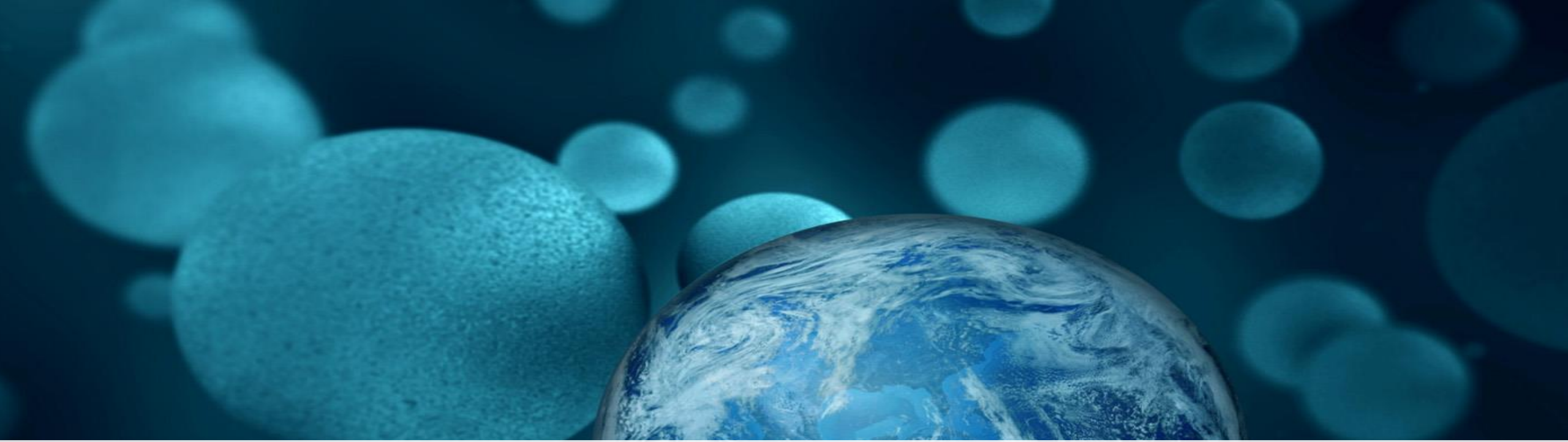


- During injection period, nitrogen flows into the column for sample introduction
- Helium is supplied at 0.1 mL/min to keep the connection swept and avoid dead volumes effects
- When GC is in stand-by, can be left in this condition with zero consumption of helium
- Separation uses helium

How the Helium Saver Module Works: Operation



- During all “non-injection” periods, Helium is supplied with a flow slightly higher than the column flow
- Helium consumption is only 1/15 – 1/20 of standard Split/Splitless injector



ThermoFisher SCIENTIFIC

The unstoppable and Off-axis Mass Spectrometer

Mass Spec Components Same for All Product Offerings

New ISQ 7000 Single Quadrupole GC-MS

Solid, homogeneous, and maintenance-free metal quadrupole rods

DynaMax™ XR detection

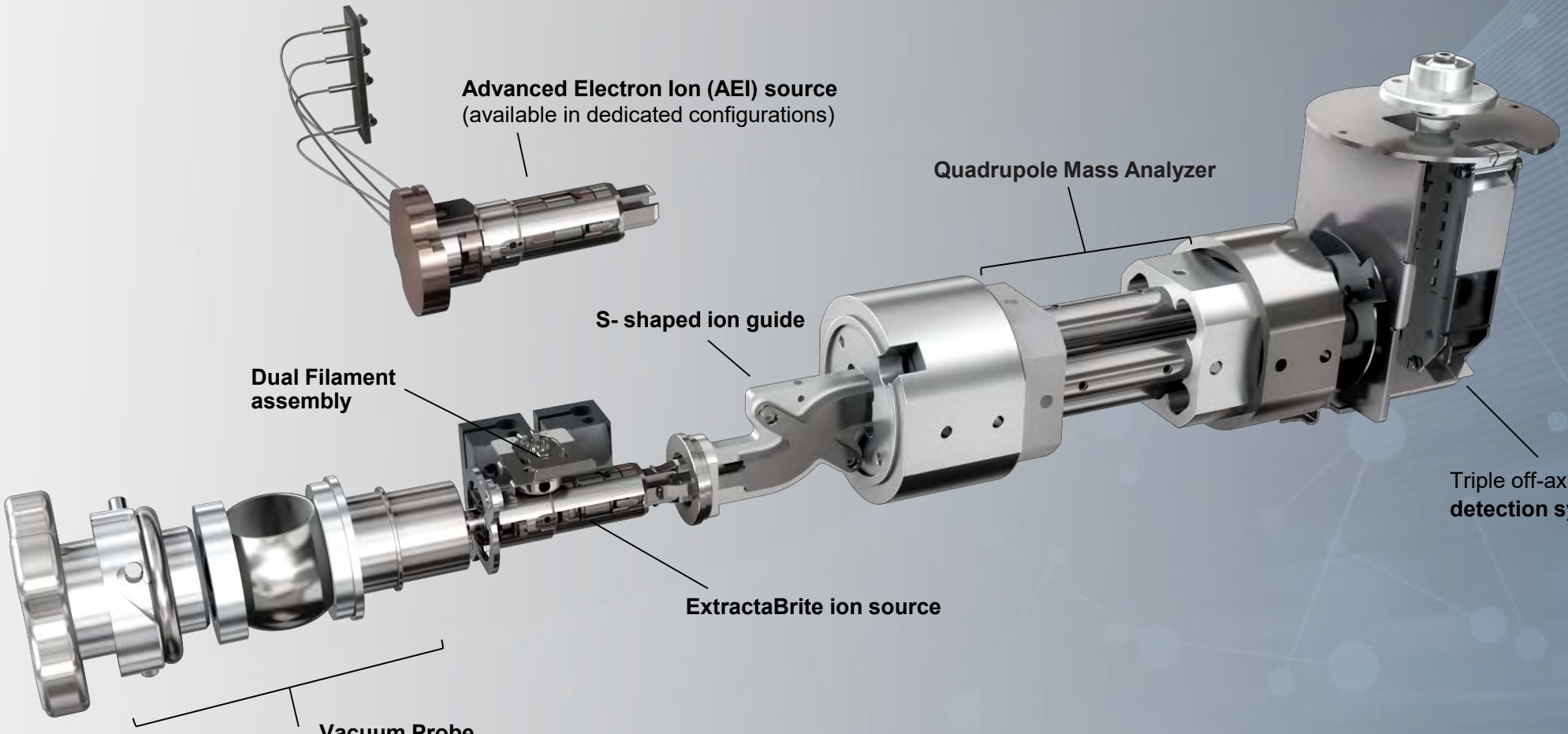
Unique Dual-Filament

s-shaped ion guide

ExtractaBrite™ ion source
or
AEI source

NO Heater !

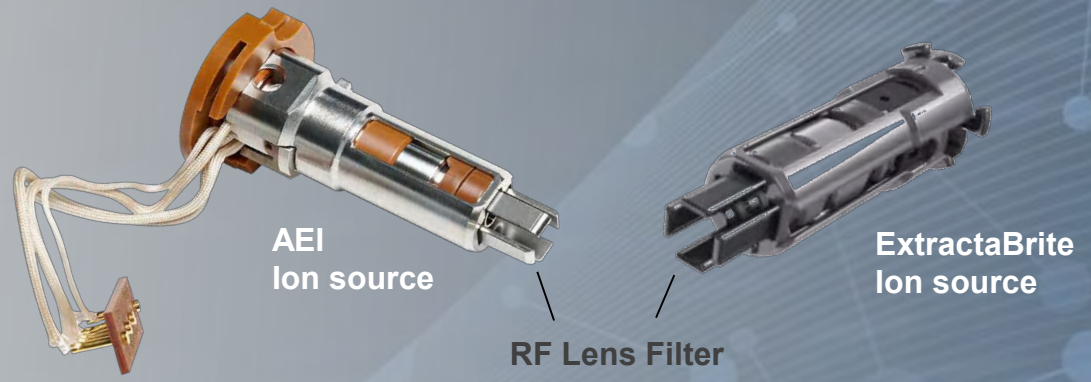
ISQ 7000 GCMS – Designed with Intention



Introducing Advanced Electron Ionization (AEI)

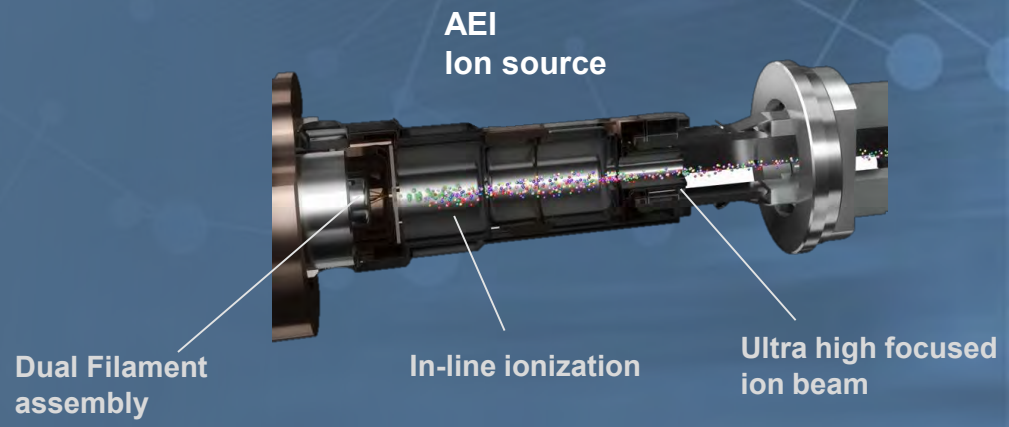
Inheriting from the ExtractaBrite™ ion source

- Highly inert material
- Independent dual heater
- Proprietary RF lenses
- Dual filament design



Adding innovative design for superior sensitivity and robustness

- Highly efficient ionization
- Tightly focused ion beam



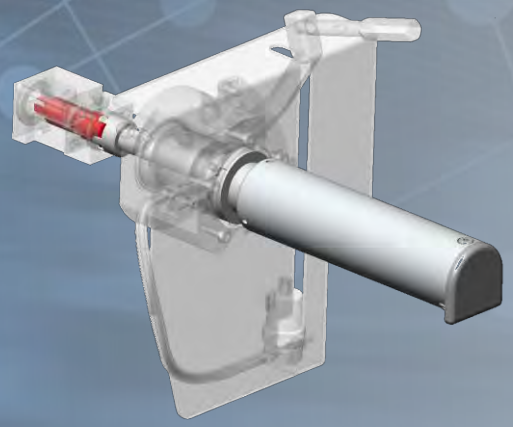
Extended uptime for enhanced laboratory efficiency

UNSTOPPABLE

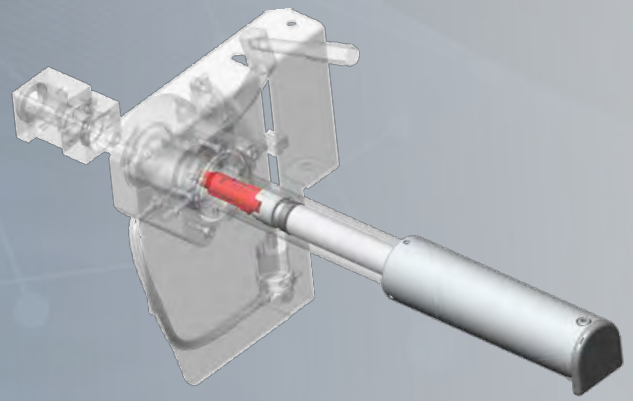
What is NeverVent™

Extends the capability of the Vacuum Probe Interlock **(VPI)** design with the newly introduced source plug, **V-Lock**

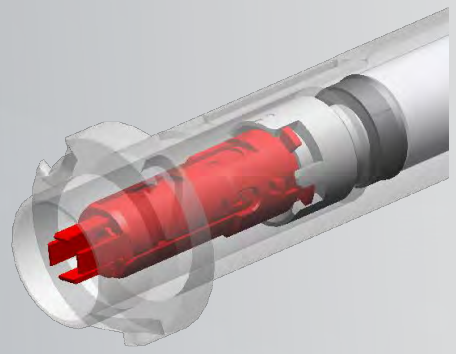
Through the VPI, no need to vent mass spec system for extracting the wireless ExtractaBrite ion source



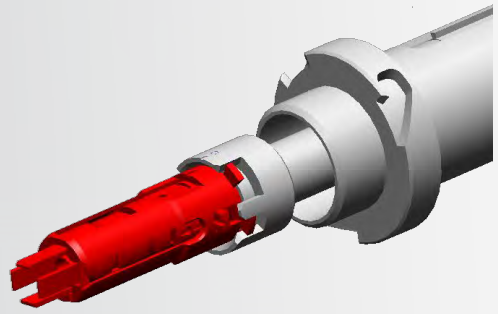
Step 1. Insert removal tool



Step 2. Remove source



Step 3. Hot source is held in tool



Step 4. Push source out of tool

What is NeverVent™

Extends the capability of the Vacuum Probe Interlock **(VPI)** design with the newly introduced source plug, **V-Lock**

V-Lock

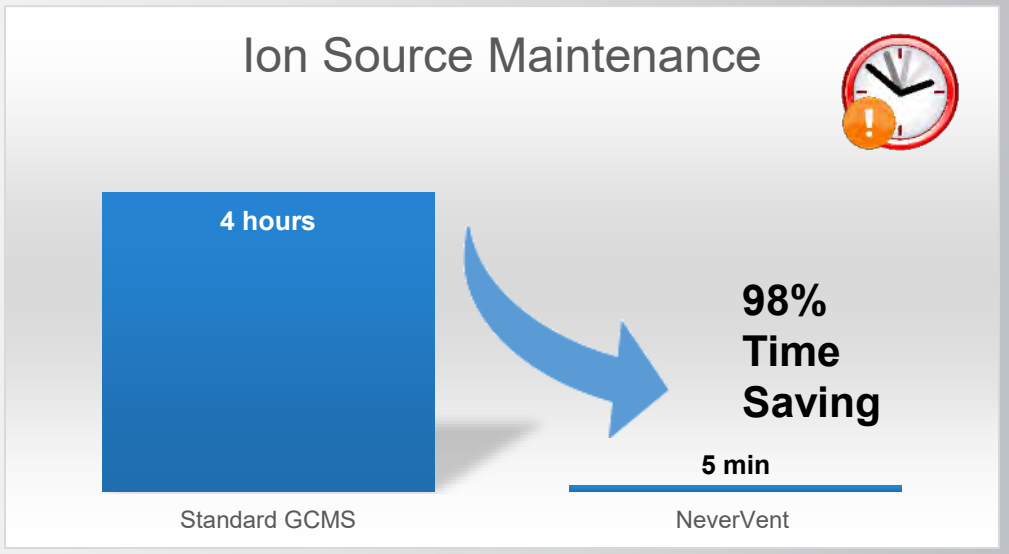
Isolate the MS under vacuum from the GC

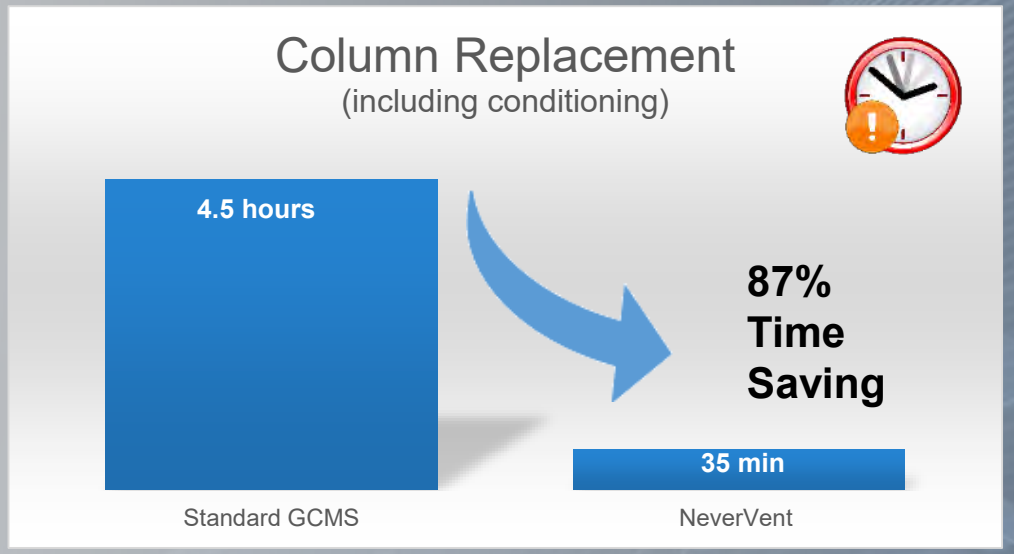
No complicated fluidics or extra connections

Through the VPI and the V-Lock source plug, no need to vent mass spec system to change the analytical column

Through the VPI and the V-Lock source plug, no need to vent mass spec system to make injector maintenance

Time saving by using the NeverVent technology





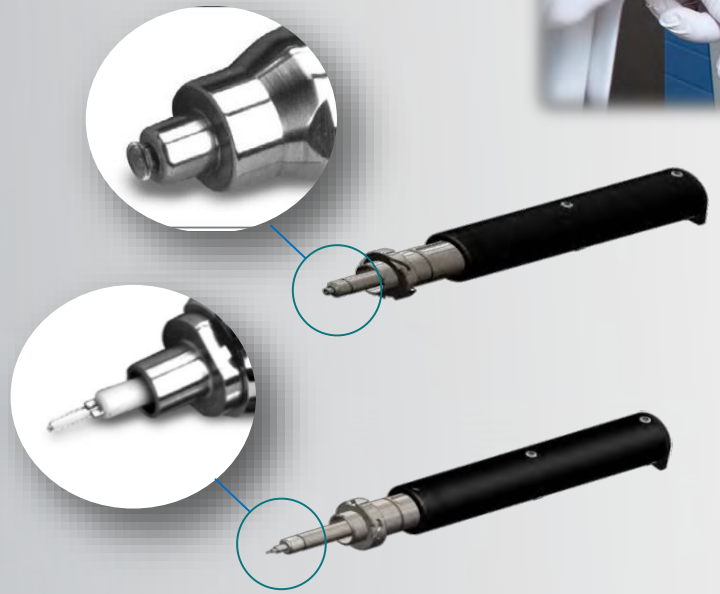
- **NeverVent reduces downtime and maximize sample analysis**
- **Increases the lab efficiency by saving the time otherwise wasted in recovering MS operation**
- **Your time can be spent on producing quality results**

Direct Sample Probe - ideal for materials difficult to elute chromatographically

- Designed to eliminate sample preparation time
- Compatible with all modes of ionization and mass analysis
- Simplified use through the Vacuum Probe Interlock (VPI)

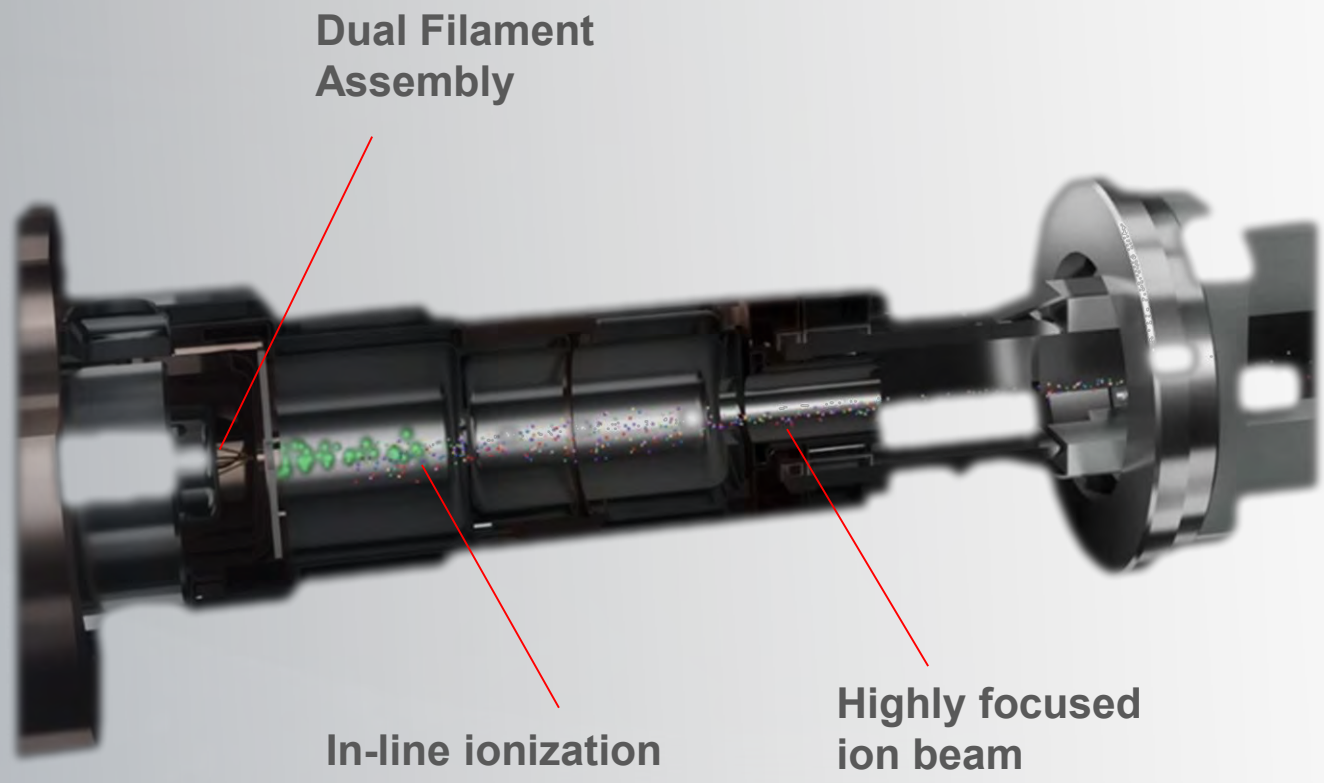
- **Direct Insertion Probe (DIP)** – ideal for solid samples or trace components in solid matrices such as forensic samples, tissue, etc.

- **Direct Exposure Probe (DEP)** – ideal for liquids or solids dissolved in a suitable solvent.



Advance Electron Ionization (AEI) source – extended robustness

- Highly focused ion beam makes this ion source extremely robust
- Maintenance frequency is significantly reduced even with difficult matrices
- Utmost sensitivity is now achieved with extended robustness, ideal for challenging samples



Thermo Scientific™ Chromeleon™ CDS

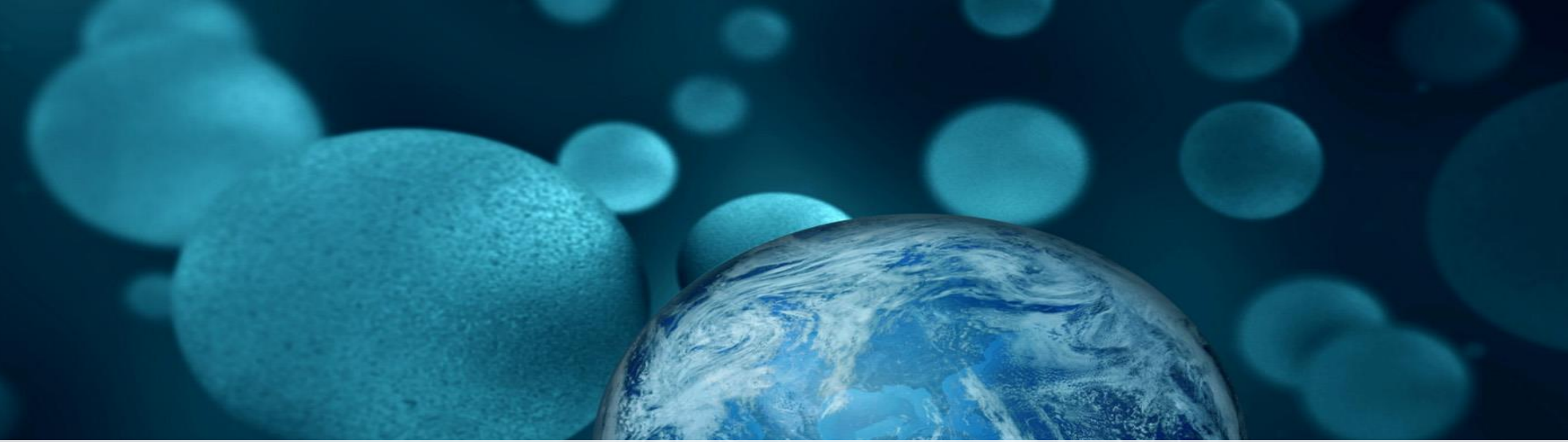
- Control your entire chromatography lab. It is fully scalable from a single workstation to an enterprise-wide installation
- Control of more than 350 modules from Thermo Fisher Scientific™ and many other vendors
- Quantitative mass spectrometry workflows for all separation techniques and MS variants, all using the same intuitive user interface.
- Boost laboratory efficiency with operational simplicity and intelligent functionality

GC & GCMS Product Portfolio

Thermo Scientific™ TRACE™ 1300 Series GC is part of our family of GC-MS solutions

Thermo Scientific™ TRACE™ 1300 Series GC	Thermo Scientific™ ISQ™ Series MS	Thermo Scientific™ TSQ™ Series MS	Thermo Scientific™ Exactive™ GC-HRMS	Thermo Scientific™ Q Exactive™ GC-HRMS	Thermo Scientific™ DFS™ HRMS
Instant Connect Modular GC	Single Quadrupole MS	Triple Quadrupole MS	Hybrid Quadrupole-Orbitrap HRMS	Hybrid Quadrupole-Orbitrap HRMS	Magnetic Sector HRMS
Detection with Multiple Detectors	Confirmation by Mass Spectrum or SIM	High speed and high capacity MS/MS and SRM	High Resolution and Accurate Mass Full Scan MS	High Resolution and Accurate Mass Full Scan & MS/MS	High-Resolution Full Scan and SIM

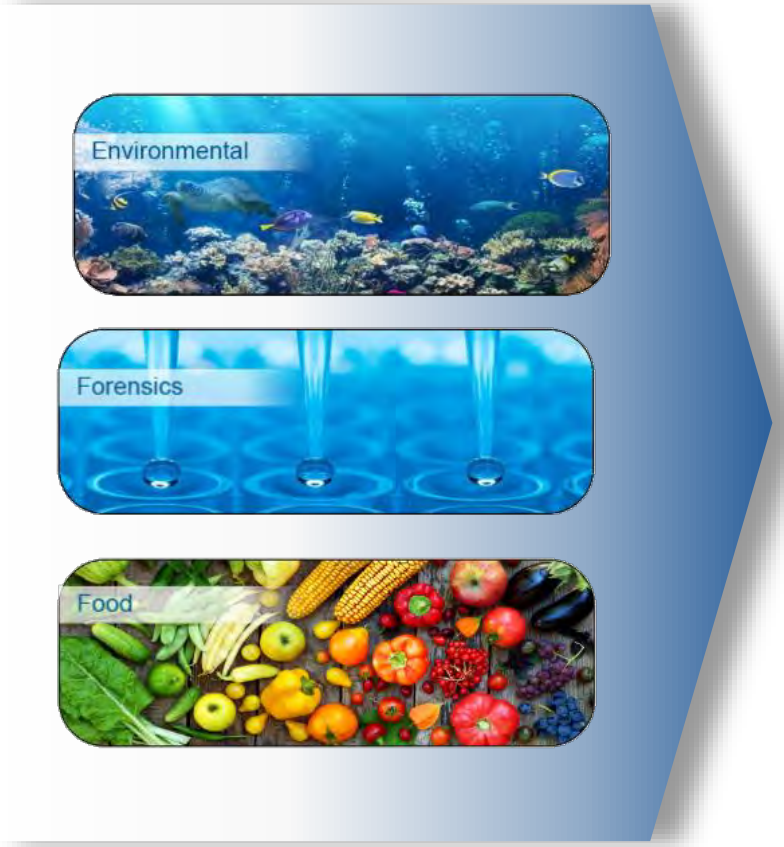
The best solutions at every level of specificity



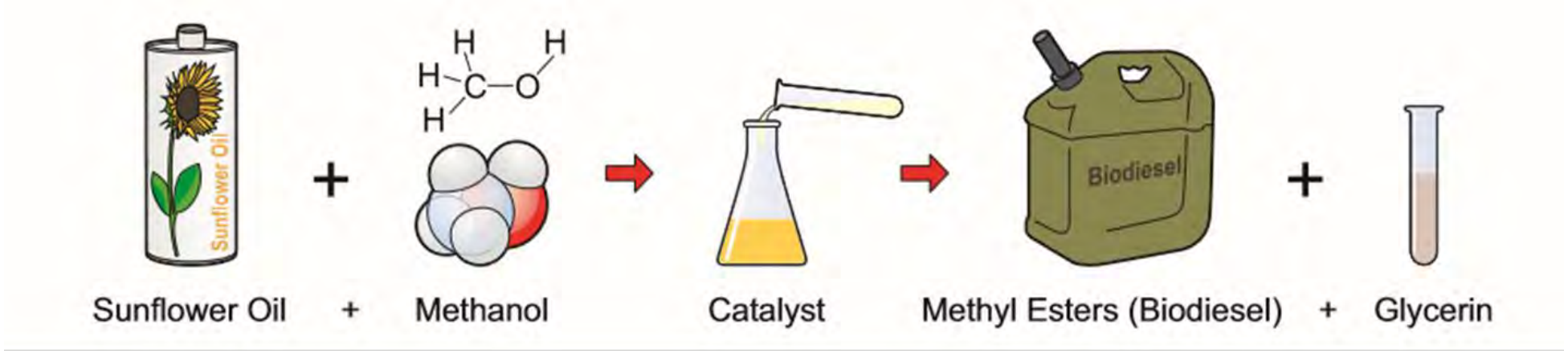
ThermoFisher SCIENTIFIC

Application on GCMSMS

GC and GCMS application support.



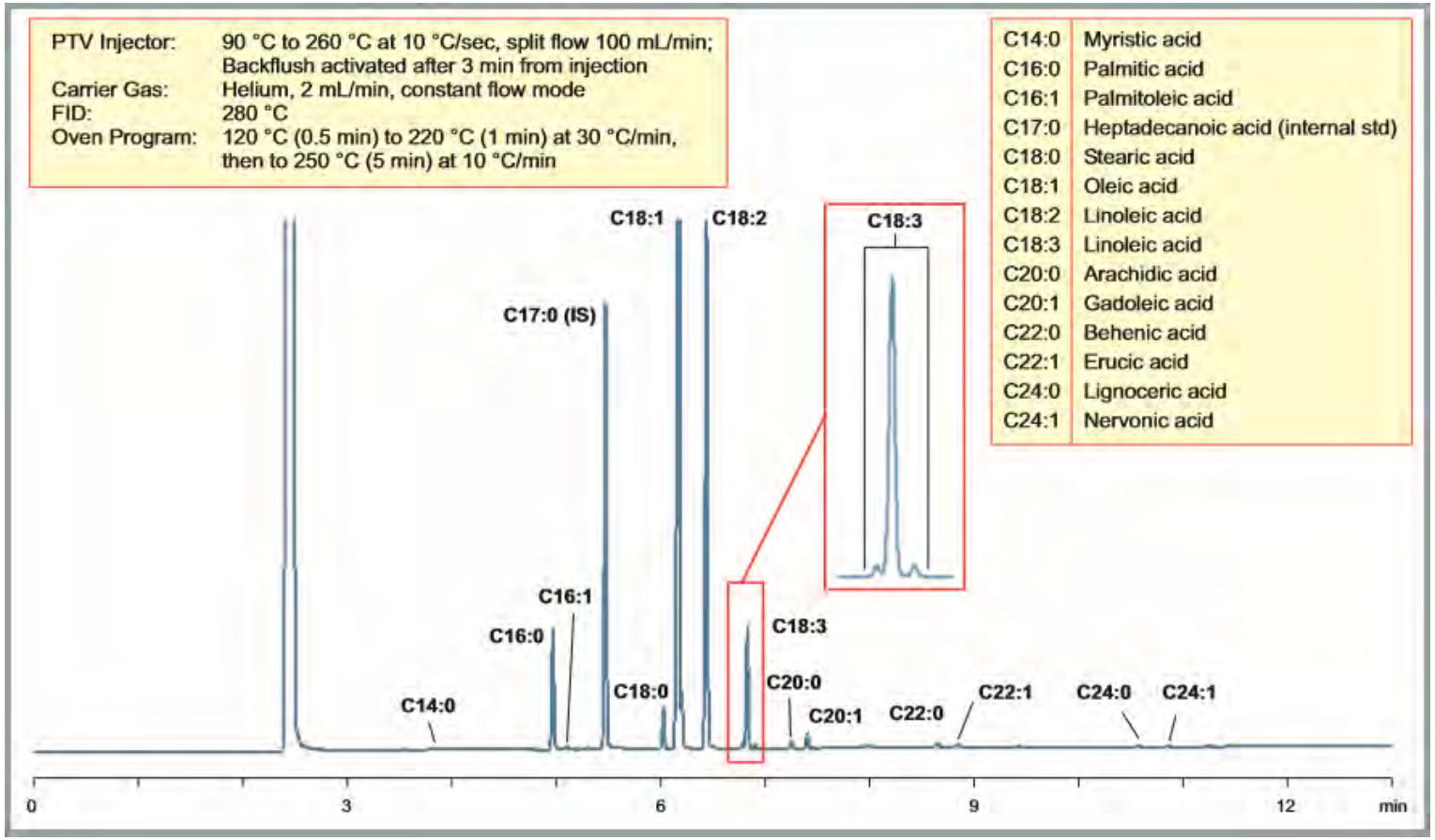
Application : Biodiesel



- Total FAME and Linolenic Acid Methyl Ester : EN 14103
- Free and Total glycerin : ASTM D6584 / EN 14150
- Methanol Content : EN 14110

Total FAME and Linolenic Acid Methyl Ester : EN 14103

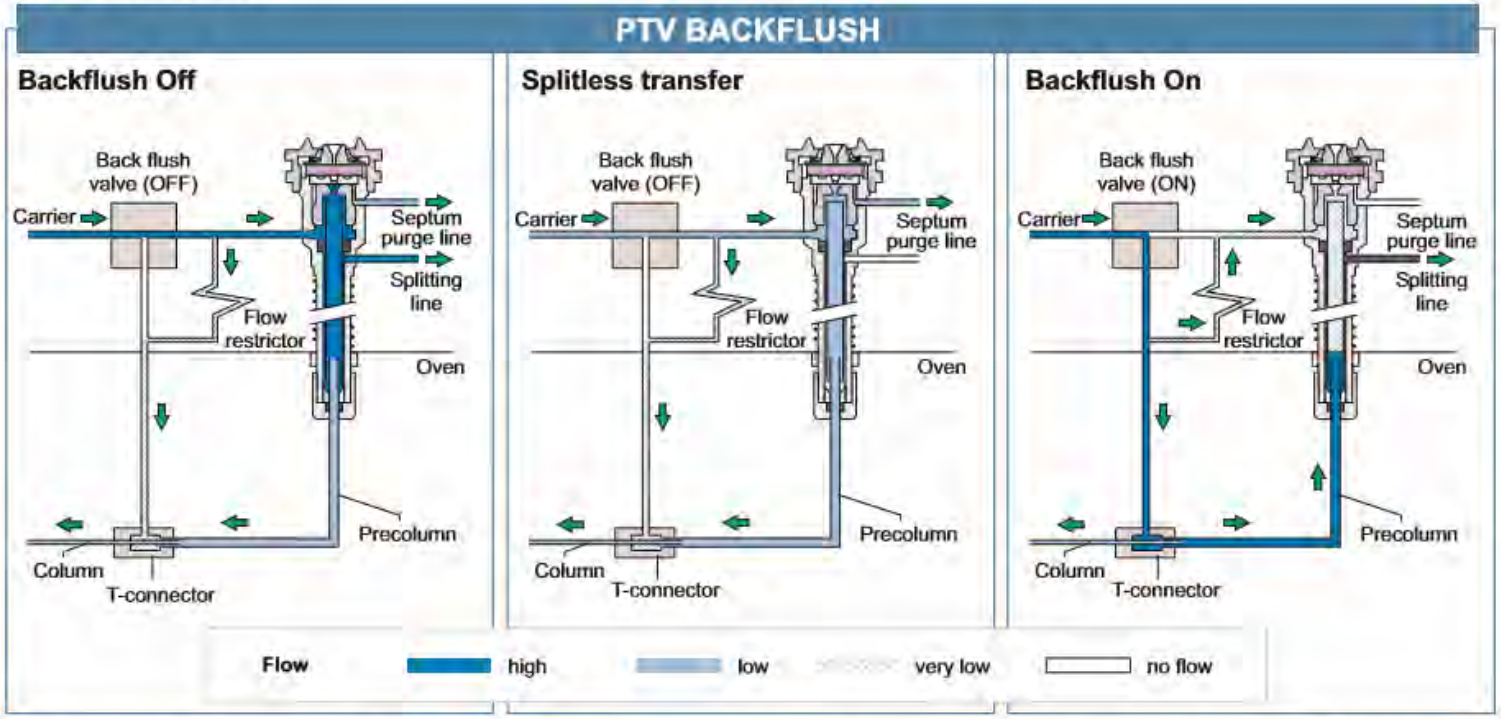
The cetane number of biodiesel depends on the distribution of fatty acids in the original oil. Thus a reliable characterization of FAME is essential for a more accurate calculation of the cetane index. EN 14103 is a standard method for determination of esters and linolenic acid methyl ester and can be applied to biodiesel analysis. EN 14103 requires GC analysis.



Total FAME and Linolenic Acid Methyl Ester : EN 14103

By incorporating the backflush option into the PTV injector, heavy compounds can be vented out of the inlet system, effectively preventing column contamination while still allowing efficient transfer of compounds of interest.

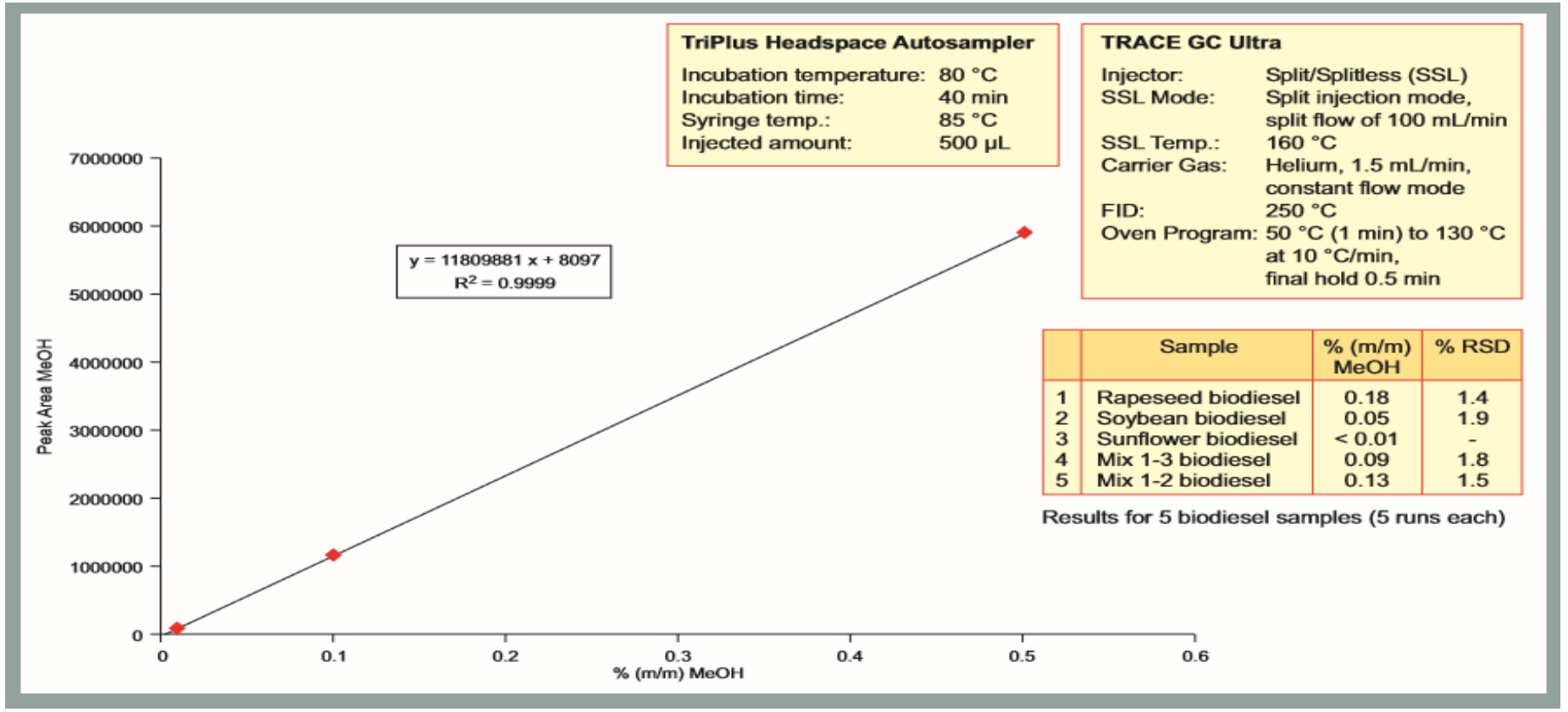
PTV Backflush



PTV Backflush (reverse flow device): the glycerides fraction is vented out without entering the column.

Methanol Content : EN 14110

Methanol in B100 is a matter of safety since even small amounts of this material can reduce the flash point of the biodiesel. Moreover, residual methanol can affect fuel pumps, seals and elastomers and can result in poor combustion properties. EN 14110 requires a headspace GC method, based on either polar or non-polar columns, and is applicable for a concentration range from 0.01% m/m to 0.5% m/m of methanol (MeOH).



	Sample	% (m/m) MeOH	% RSD
1	Rapeseed biodiesel	0.18	1.4
2	Soybean biodiesel	0.05	1.9
3	Sunflower biodiesel	< 0.01	-
4	Mix 1-3 biodiesel	0.09	1.8
5	Mix 1-2 biodiesel	0.13	1.5

Results for 5 biodiesel samples (5 runs each)

ASE™ 350

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SciSpec

Sample Preparation

Dried leaves , fruits or seeds and other herbal products

Weight 10 g of sample.

Mixed with DE and load into the extraction cells.

Concentrated Sample and injection with GC

ASE™ 350

Sample weight	10 g
Extraction solvent	Ethylacetate/cyclo-Hexane 1:1, same as GPC solvent
Temperature	120 °C
Pressure	100 bar
Extraction time	5 min, 1 cycle
Flushing with solvent	60% of cell volume
Flushing with nitrogen	100 s

GC : Condition

Injector PTV	Splitless mode
Base temperature	50 °C
Transfer	10 °C/s to 250 °C, until end of run
Flow	Constant flow, 1.2 mL/min, helium
Analytical column	40 m, ID 0.18 mm, 0.18 µm film, 5%-phenyl phase (5MS type)
Pre-column	5 m, ID 0.18 mm, empty deactivated, no backflush
Column oven	Temperature programmed
Start	70 °C, for 1.50 min
Ramp 1	15 °C/min to 190 °C
Ramp 2	7 °C/min to 290 °C, 12 min
Transfer line	250 °C

MS/MS : Condition

Ion source temperature	220 °C
MRM Detection	Timed SRM mode (see Appendix)

SRM : More than 80 compound

Pesticide Name	RT (min)	Precursor Mass (m/z)	Product Mass (m/z)	Collision Energy (V)
Difluorobenzamid Degradation (Isocyanat)	6.93	152.93	90.01	20
Difluorobenzamid Degradation (Isocyanat)	6.93	152.93	125.01	20
Carbofuran 1	8.80	149.06	121.05	10
Carbofuran 1	8.80	164.08	149.07	10
Difluorobenzamid Degradation	8.62	141.00	63.11	25
Difluorobenzamid Degradation	8.62	141.00	113.09	15
Biphenyl-d10_ISTD	9.24	160.00	160.16	10
Biphenyl	9.28	154.08	153.08	15
Biphenyl	9.28	153.08	152.08	15
Carbofuran-3-hydroxy 1	10.43	137.05	81.01	18
Carbofuran-3-hydroxy 1	10.43	180.05	137.01	15
Tetrahydrophthalimid	10.84	151.04	79.01	25
Tetrahydrophthalimid	10.84	151.04	122.09	10
O-Phenylphenol	11.00	170.07	141.06	20
O-Phenylphenol	11.00	170.07	115.05	20
Molinate	11.10	187.10	126.07	10
Molinate	11.10	126.07	98.05	5
Chlorfenprop methyl	11.59	196.00	165.00	10
Chlorfenprop methyl	11.59	165.00	137.00	10
Fenobucarb	11.20	121.07	77.05	15
Fenobucarb	11.20	150.09	121.07	10
Propachlor	11.76	176.06	120.04	10
Propachlor	11.76	120.04	92.03	10
Propachlor	11.76	169.06	120.04	10
Propachlor	11.76	196.07	120.04	10
Cycloate	11.98	154.10	83.05	10
Cycloate	11.98	215.13	154.10	5
Diphenylamin	11.49	169.01	168.09	20
Diphenylamin	11.49	169.01	167.09	20
Chloropropham	12.26	213.06	127.03	15
Chloropropham	12.26	213.06	171.04	10
Phosmet-oxon	12.09	160.00	132.96	15
Phosmet-oxon	12.09	104.00	75.88	10
Phosmet-oxon	12.09	160.00	76.96	20
Prometon	13.10	225.16	183.13	10
Prometon	13.10	225.16	210.15	10
Carbofuran 2	13.13	149.06	121.05	10
Carbofuran 2	13.13	164.08	149.07	10
Profluralin	13.22	318.10	199.06	15
Profluralin	13.22	330.23	262.45	25
Swep	13.46	187.05	123.95	18
Swep	13.46	219.11	174.02	15
Trietazine	13.48	229.14	200.14	15
Trietazine	13.48	214.14	186.10	15
Dimethipin	13.53	117.98	57.97	10
Dimethipin	13.53	210.10	76.02	10
Terbutylazin	12.97	214.10	132.06	10
Terbutylazin	12.97	214.10	104.05	10
Propyzamid	13.04	173.01	145.01	15
Propyzamid	13.04	173.01	109.01	18
Propyzamid	13.04	175.02	147.01	15
Propyzamid	13.04	254.02	226.02	15
Isocarbamide	13.67	142.03	70.01	15
Isocarbamide	13.67	142.03	113.01	10
Dinoseb	13.92	211.13	116.99	15
Dinoseb	13.92	211.13	163.11	10
Terbazil	13.42	161.05	88.03	15
Terbazil	13.42	160.05	76.02	15
Bromocylen	14.37	358.79	242.85	15
Bromocylen	14.37	356.93	241.24	15
Dimethenamid	14.60	230.06	154.04	10
Dimethenamid	14.60	232.06	154.04	10
Dimethachlor	14.61	197.08	148.06	10
Dimethachlor	14.61	199.08	148.06	10
Acetochlor	14.65	174.11	146.15	15
Acetochlor	14.65	223.19	147.17	10
Desmetryn	14.68	213.11	171.08	10
Desmetryn	14.68	213.11	198.10	10
Flurprimidol	14.77	269.12	106.98	20
Alachlor	14.26	188.10	160.07	10
Alachlor	14.26	188.10	130.12	25
Alachlor	14.26	237.14	160.15	10
Metribuzin	14.14	198.08	82.03	20
Metribuzin	14.14	198.08	89.04	16
Propanil	15.00	217.01	161.00	10
Propanil	15.00	219.01	163.00	10
Fipronildesulfinyl	14.15	333.00	231.20	20
Fipronildesulfinyl	14.15	333.00	281.30	20
Carbofuran-3-hydroxy 2	15.02	137.05	81.01	18
Carbofuran-3-hydroxy 2	15.02	180.05	137.01	15
Prometryn	14.49	241.14	184.10	15
Prometryn	14.49	226.13	184.10	12
Tridiphan	15.18	186.94	158.94	15
Tridiphan	15.18	219.09	184.09	20
Ethofumesat	14.80	206.82	160.86	10
Ethofumesat	14.80	285.75	206.82	12
Pentanochlor	15.73	141.05	106.05	15
Pentanochlor	15.73	239.05	141.05	15
Chlorpyrifos	15.78	257.97	165.98	20
Chlorpyrifos	15.78	314.05	258.18	15
Bromacil	15.03	205.01	188.01	15
Bromacil	15.03	207.01	190.01	15
Anthrachinon	15.44	207.97	151.99	20
Anthrachinon	15.44	180.04	152.05	15
Anthrachinon	15.44	207.97	180.10	10
Nithrothal isopropyl	16.09	236.08	194.07	10
Nithrothal isopropyl	16.09	236.08	148.05	20
Triadimefon	15.41	208.07	181.06	10
Triadimefon	15.41	210.07	183.06	10
Tiocarbazil	16.15	156.08	100.05	8
Tiocarbazil	16.15	279.10	156.07	6
Tetraconazol	15.39	336.02	218.01	20
Tetraconazol	15.39	338.02	220.01	20
Butralin	15.54	266.14	220.11	15
Butralin	15.54	266.14	190.10	15
Dicapthon	15.44	262.00	262.00	9
Dicapthon	15.44	262.00	216.00	13
Crufomat	16.30	256.20	226.15	25
Crufomat	16.30	276.20	182.09	10
Allethrin	16.17	123.07	80.98	10
Allethrin	16.17	136.04	92.98	10
Dinobuton	16.89	163.06	116.04	15
Dinobuton	16.89	211.07	117.04	18
Penconazol	16.89	248.06	157.04	25
Penconazol	16.89	248.06	192.04	15
Pyrifenox 1	16.17	262.03	192.02	20
Pyrifenox 1	16.17	262.03	200.02	20
Pyrifenox 2	16.81	262.03	192.02	20
Pyrifenox 2	16.81	262.03	200.02	20
Famophos (Famphur)	20.16	218.07	108.94	15
Famophos (Famphur)	20.16	218.07	126.95	20
Iprodion Degradation	18.63	186.87	123.99	20
Iprodion Degradation	18.63	186.87	159.02	15
Iprodion Degradation	18.63	243.94	187.02	10
Iprodion	20.57	314.06	245.25	15
Iprodion	20.57	186.99	123.87	20
Iprodion	20.57	316.00	247.35	15
Iprodion	20.57	316.00	273.11	10
Propiconazol 1	19.38	259.02	173.02	20
Propiconazol 1	19.38	172.94	144.91	15
Propiconazol 2	19.54	259.02	173.02	20
Propiconazol 2	19.54	172.94	144.91	15
Pyraflufen-ethyl	20.30	412.02	349.02	15
Pyraflufen-ethyl	20.30	349.02	307.02	15
Clodinafop-propargyl	20.36	349.05	266.04	15
Clodinafop-propargyl	20.36	349.05	238.04	15
Lenacil	20.70	153.05	136.06	15
Paclobutrazole	17.75	238.11	127.06	15
Chinomethionat	17.78	206.06	147.98	15
Chinomethionat	17.78	234.08	206.06	10
Napropamid	18.07	271.16	128.07	5
Napropamid	18.07	128.07	72.04	10
Flutriafol	18.11	219.07	123.04	15
Flutriafol	18.11	123.04	75.03	15
Flurodifen	18.14	190.02	126.01	10
Flurodifen	18.14	190.02	146.01	5
Bisphenol A	18.17	213.14	119.06	15
Bisphenol A	18.17	213.14	164.99	20
Bisphenol A	18.17	228.15	213.07	10
Chlorfenson_ISTD	18.20	302.00	110.90	20
Hexaconazol	18.22	214.08	159.07	20
Hexaconazol	18.22	214.08	151.98	25
Imazalil	18.24	172.96	144.96	15
Imazalil	18.24	172.96	108.95	25
Isoprothiolan	18.24	203.99	117.95	7
Isoprothiolan	18.24	203.99	84.90	25
Isoprothiolan	18.24	290.06	118.03	15
Flamprop-methyl	18.39	230.05	170.04	10
Flamprop-methyl	18.39	276.06	105.02	10
Kresoximmethyl	18.48	206.10	131.09	15
Kresoximmethyl	18.48	206.10	116.01	10
Buprofezin	18.51	175.08	116.96	20
Buprofezin	18.51	175.08	131.99	15
Buprofezin	18.51	249.16	105.93	20
Azinphosmethyl	22.95	160.00	132.00	10
Azinphosmethyl	22.95	160.00	104.64	10
Pyriproxyfen	23.06	136.00	77.92	20
Fenamirol	23.55	251.02	139.01	15
Fenamirol	23.55	330.03	139.01	10
Pyridaben	24.50	364.14	309.12	5
Pyridaben	24.50	309.12	147.06	15
Fluquinconazol	24.59	340.01	298.01	22
Fluquinconazol	24.59	342.01	300.01	22
Etofenprox	26.05	163.09	107.06	16
Etofenprox	26.05	163.09	135.07	10
Etofenprox	26.05	376.14	135.02	30
Etofenprox	26.05	376.14	163.09	10
Silafluofen	26.25	179.00	151.00	7
Silafluofen	26.25	286.13	258.12	15
Difenconazol 1	26.91	323.05	265.04	15
Difenconazol 1	26.91	325.05	267.04	20
Difenconazol 2	27.05	323.05	265.04	15
Difenconazol 2	27.05	325.05	267.04	20
Indoxacarb	28.55	264.02	176.14	10
Indoxacarb	28.55	264.02	148.03	20
Indoxacarb	28.55	321.05	289.34	10

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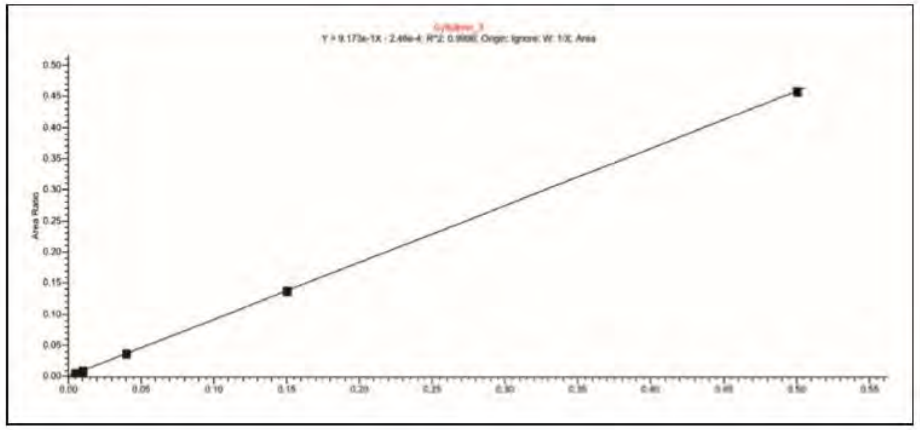
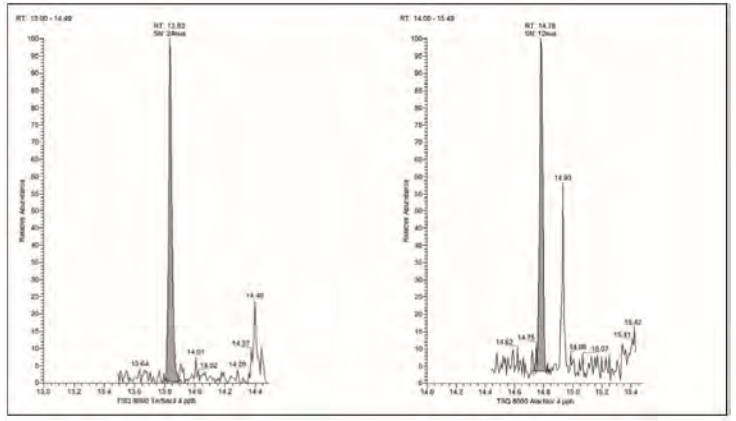
Calibration and Detection limit.

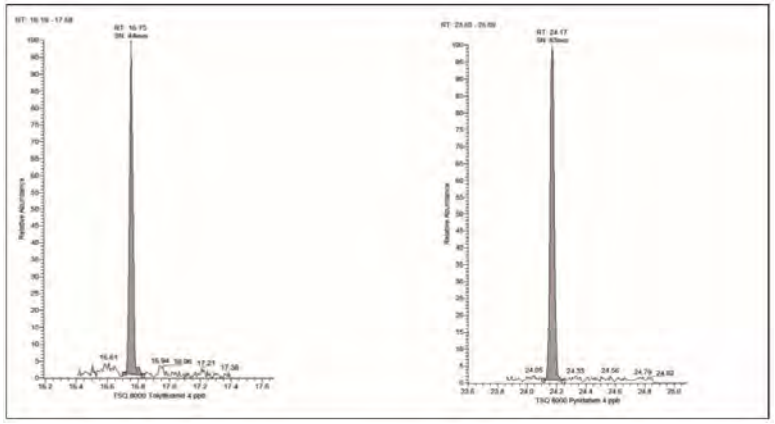
Calibration level : 0.004 µg/mL to 1.0 µg/mL(This range represents an analyte concentration of 0.01 to 2.5 mg/kg in the samples)



Pesticide	RT [min]	S/N @ 4 ppb
Terbacil	13:83	24
Alachlor	14:78	12
Tolylfluanid	16:75	44
Pyridaben	24:17	83

Sensitivity (LOD)





Terbacill Alachor Tolyfluanid Pyridaben

Sample Result…..

Sample Matrix	Pesticide Residues Found	Concentration (mg/kg)
Dried Herbs	o-Phenylphenol	0.017
Dried Herbs	Tebuconazol	0.023
Dried Fruit	Diflubenzuron	0.049
Dried Fruit	Myclobutanil	0.023
Dried Fruit	Propargit	0.479
Dried Fruit	Tebuconazol	0.081
Dried Fruit	Difenconazol	0.013
Dried Herbs	Picoxystrobin	0.228
Dried Herbs	Picoxystrobin	0.233
Dried Herbs	o-Phenylphenol	0.011
Herbal Tea	o-Phenylphenol	0.014
Herbal Tea	o-Phenylphenol	0.011
Herbal Tea	Terbutylazin	0.016

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PY-GCMS

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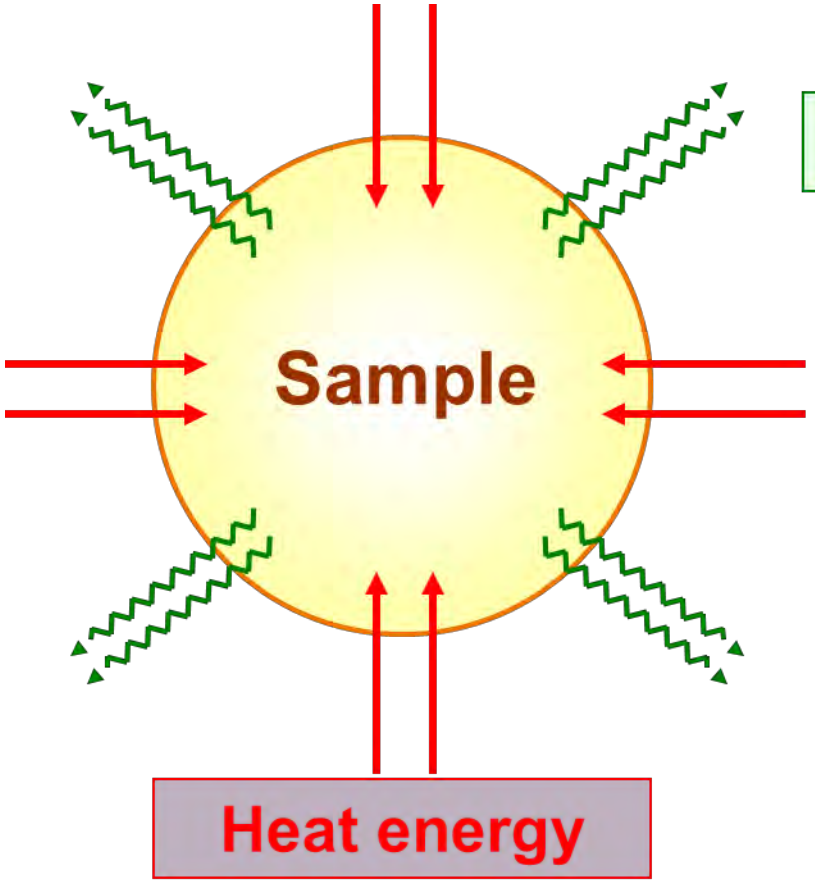
Pyrolyzer

Information from polymeric Materials by Heating



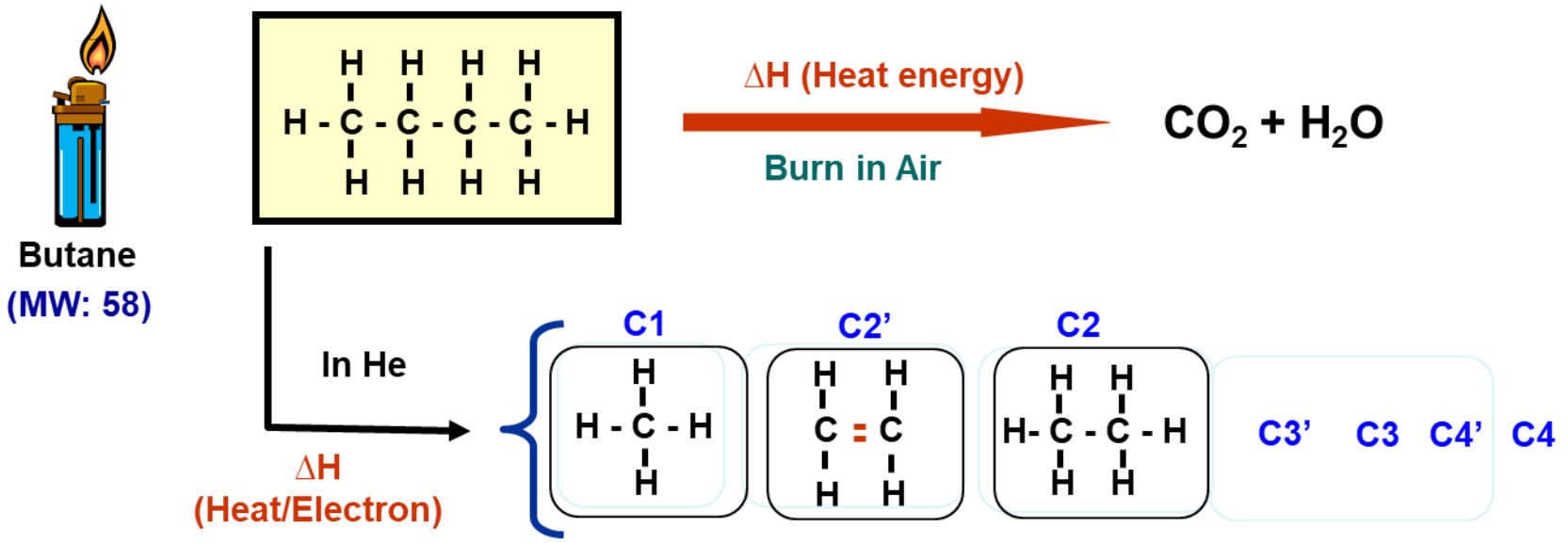
Information

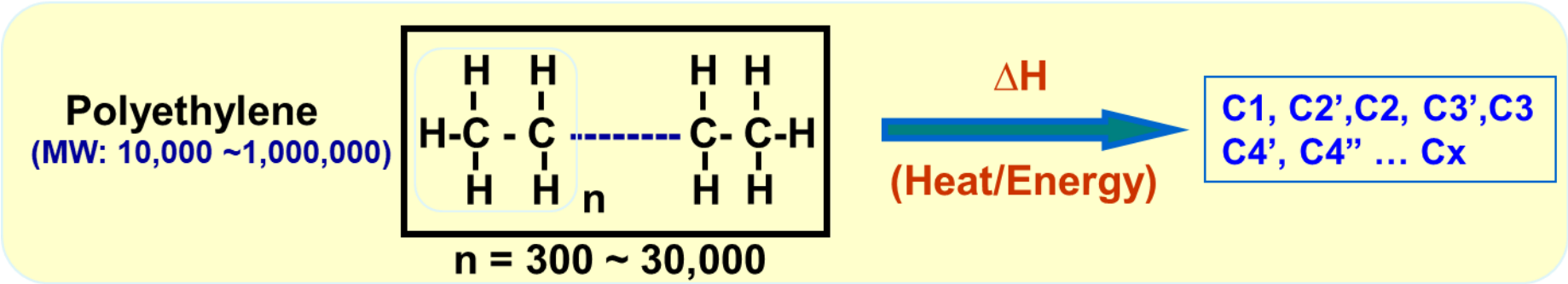
- Weight loss: **TGA**
- Enthalpy change: **DTA, DSC**
- Mechanical change: **TMA, Dilatometry**
- Evolved gas
  - volume: **EGA (volume of gas)**
  - qualification & quantification:

Py-GC/MS
TD-GC/MS
UV/Py-GC/MS
EGA/MS
Py/MS

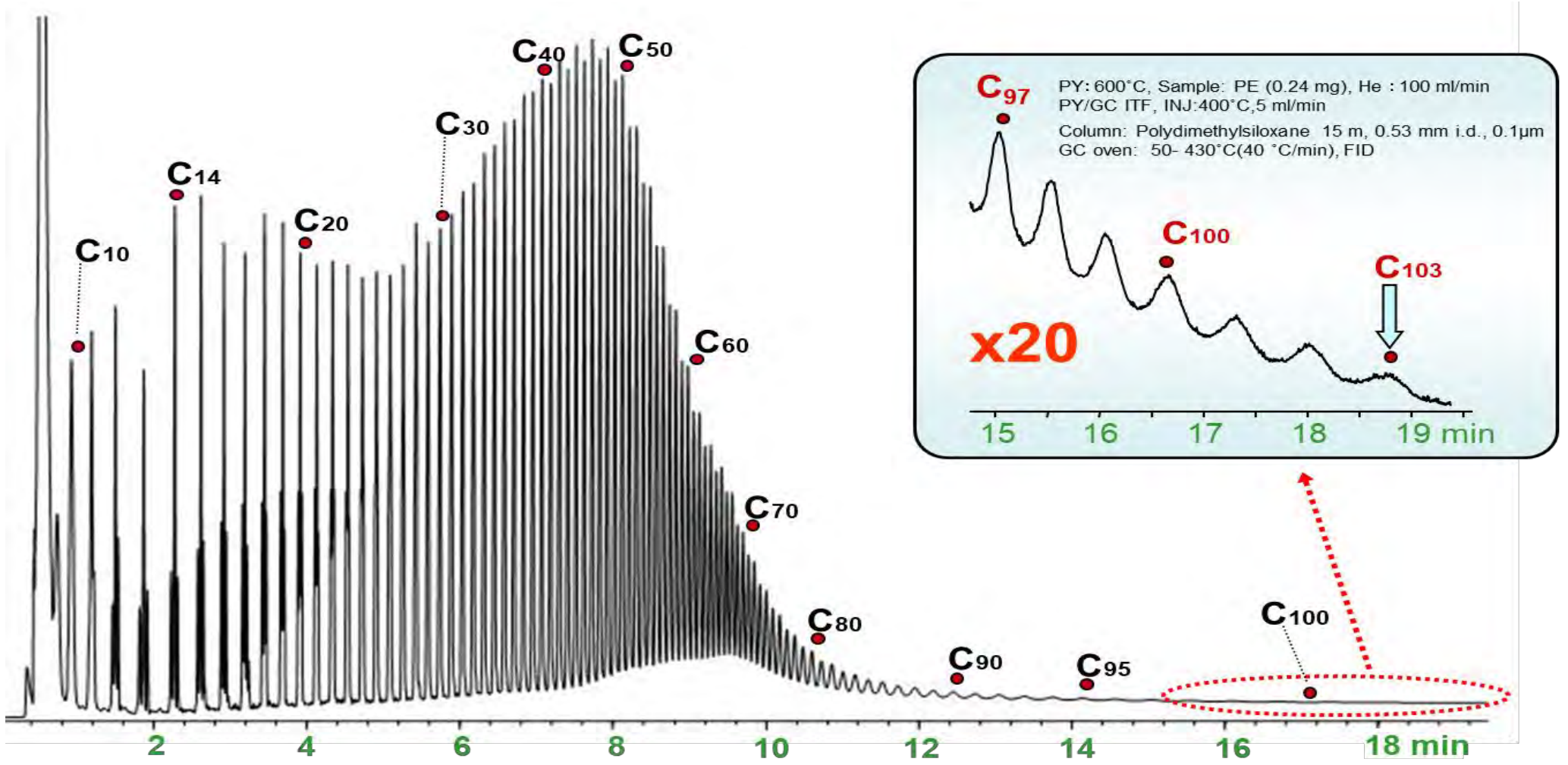
Pyrolyzer

Pyrolysis of Polymeric materials and pyrolyzates



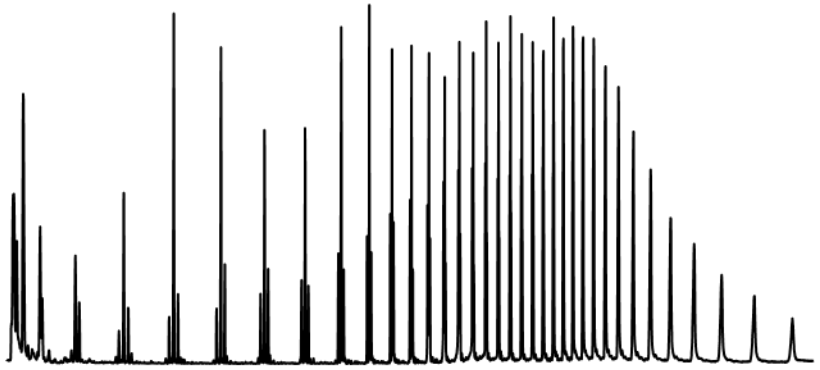


Typical pyrogram of polyethylene at 600ºC

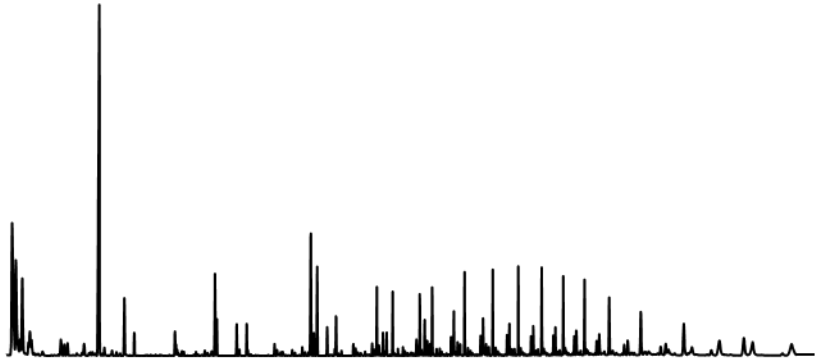


Pyrolyzer

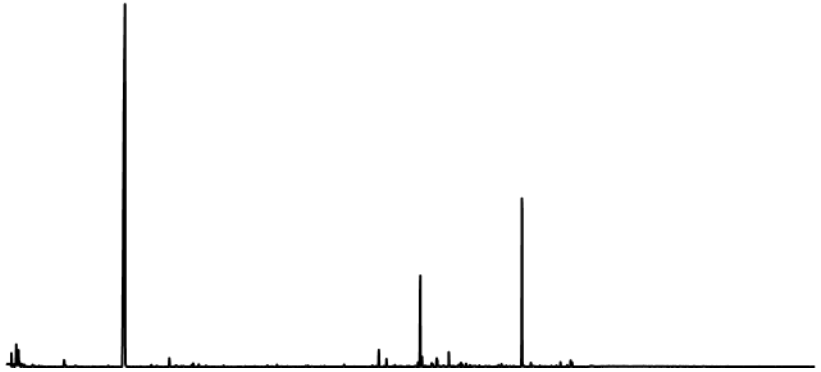
Polyethylene



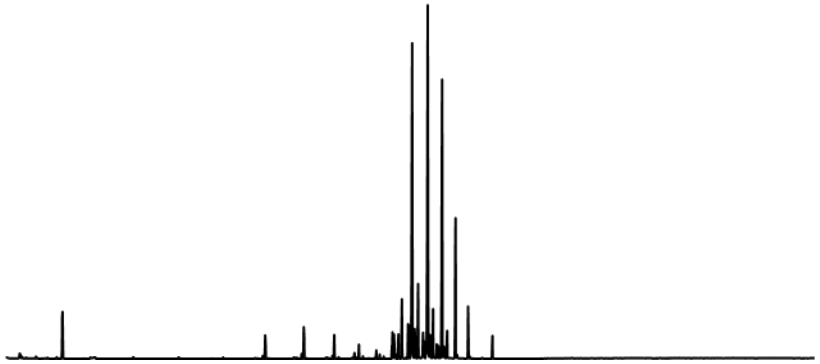
Polypropylene



Polystyrene



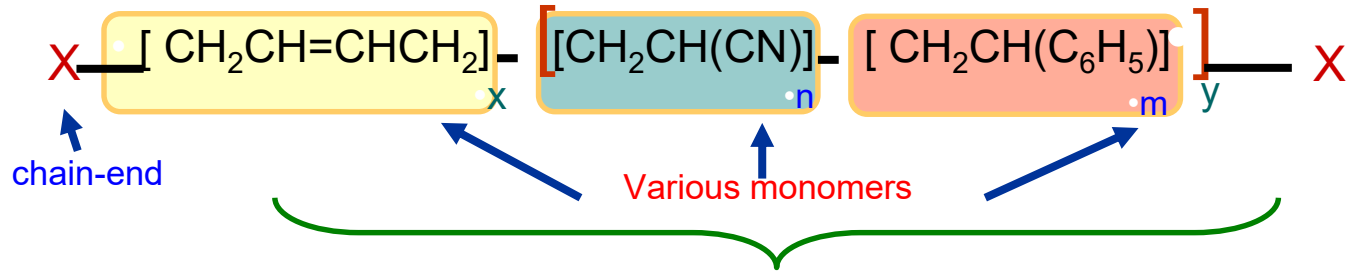
Higher methacrylate copolymer

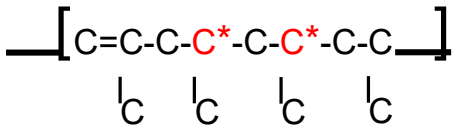


A: Identification of polymeric materials

Unknown materials (PP/ PVC/ SBR?)

B: Structural characterization of polymers

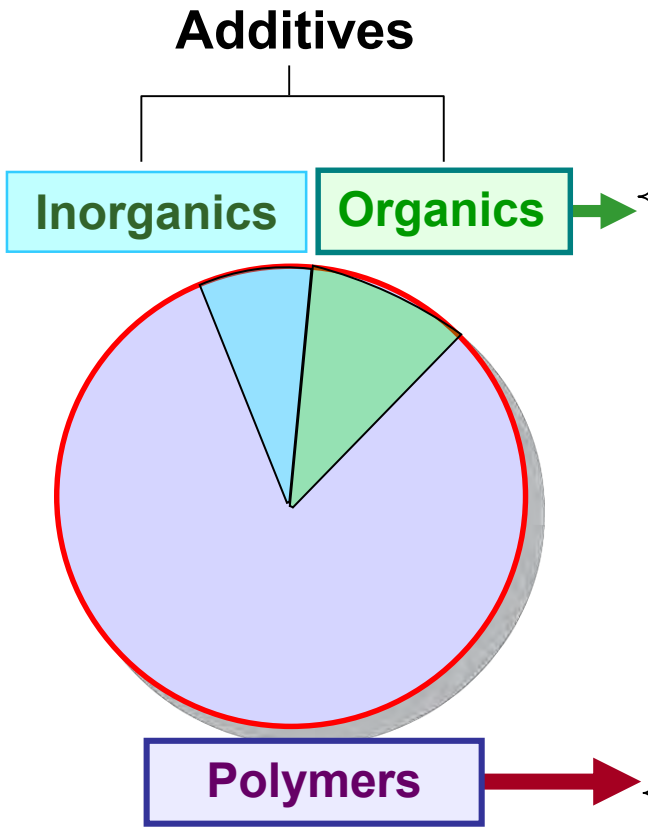




C: Mechanisms and kinetics of polymer degradation

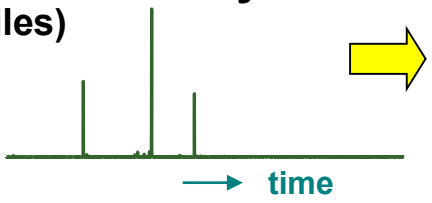
D: Qualitative and quantitative analysis of additives

F-Search Software



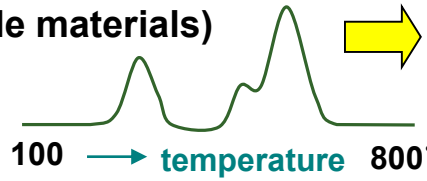
- NIST, Wiley libraries (containing some additives)

- TD-GC/MS analysis
  (Volatiles)



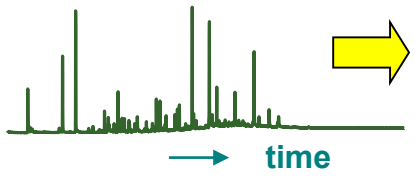
- Additive-MS library

- EGA-MS analysis
  (Whole materials)



- Polymer EGA-MS library

- Py-GC/MS analysis
  (Whole materials)



- Polymer PyGC-MS library
- Polymer Pyrolyzate-MS library

Classification of 700 polymers in the libraries

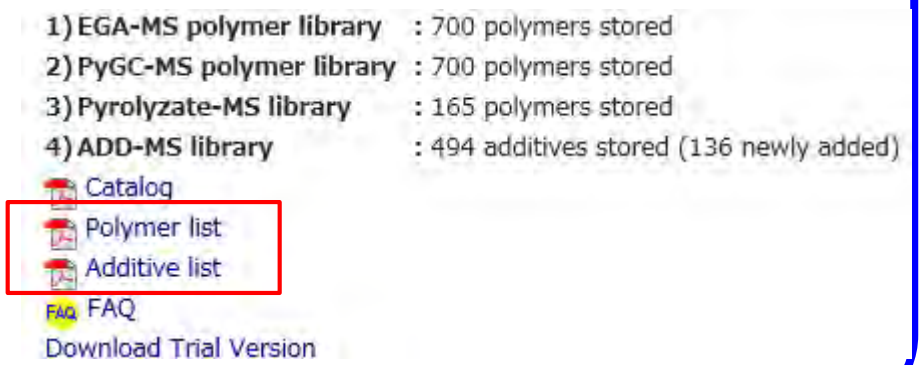
1) Vinyl ploymers with ethylene unit
2) Polyolefines
3) Vinyl polymers with styrene unit
4) Vinyl polymers with styrene derivative unit
5) Acrylic polymers
6) Chlorine containing vinyl polymers
7) Fluorine containing vinyl polymers
8) Polyvinyl alcohols and its ester polymers
9) Diene - elastomers

10) Polyamide
11) Polyacetals and polyethers
12) Thermosetting resines
13) Engineering plastics of polyimide and aramide type
14) Engineering plastics of polyester type
15) Other engineering plastics with phenylene backbone
16) Silicone polymers
17) Cellulose polymers
18) Polyurethanes
19) Others

Classification of 494 additives in the library

1) Antioxidant
2) Ultraviolet absorber, Light stabilizer
3) Metal deactivator
4) Stabilizer
5) Lubricant
6) Plasticizer
7) Antistatic additive
8) Anti-clouding agents
9) Fire retardant
10) Blowing agent
11) Conductive agent
12) Nucleating agent
13) Optical characteristic controlling agent
14) Antibacterial, Antifungal agent
15) Resin modifier
16) Vulcanization accelerator
17) Antidegradant

download the complete list from
http://www.frontier-lab.com/english/multi-functional-pyrolysis-system/



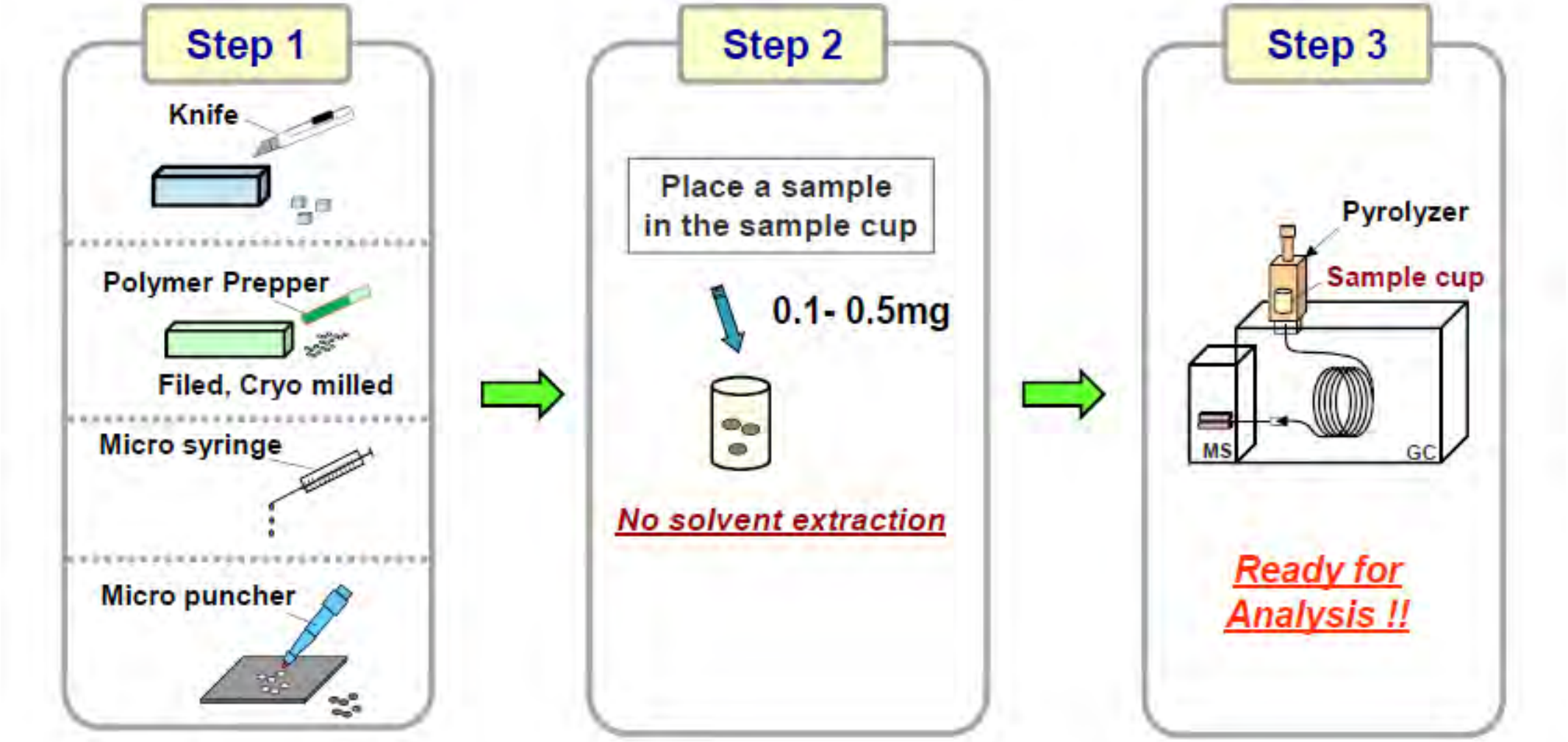
ตัวอย่างการวิเคราะห์ด้วย PY-GCMS

- สภาวะเครื่อง GCMS
- Injector
  - Temperature 300 °C
  - Split 200:1
  - Carrier gas flow 1.0 ml/min
- Oven
  - Initial 70 °C hold 1min ramp 1 ; 10 °C/min to 320 °C hold 8 min.
- MS
  - Temperature 250 °C
  - Scan 35-550 amu.

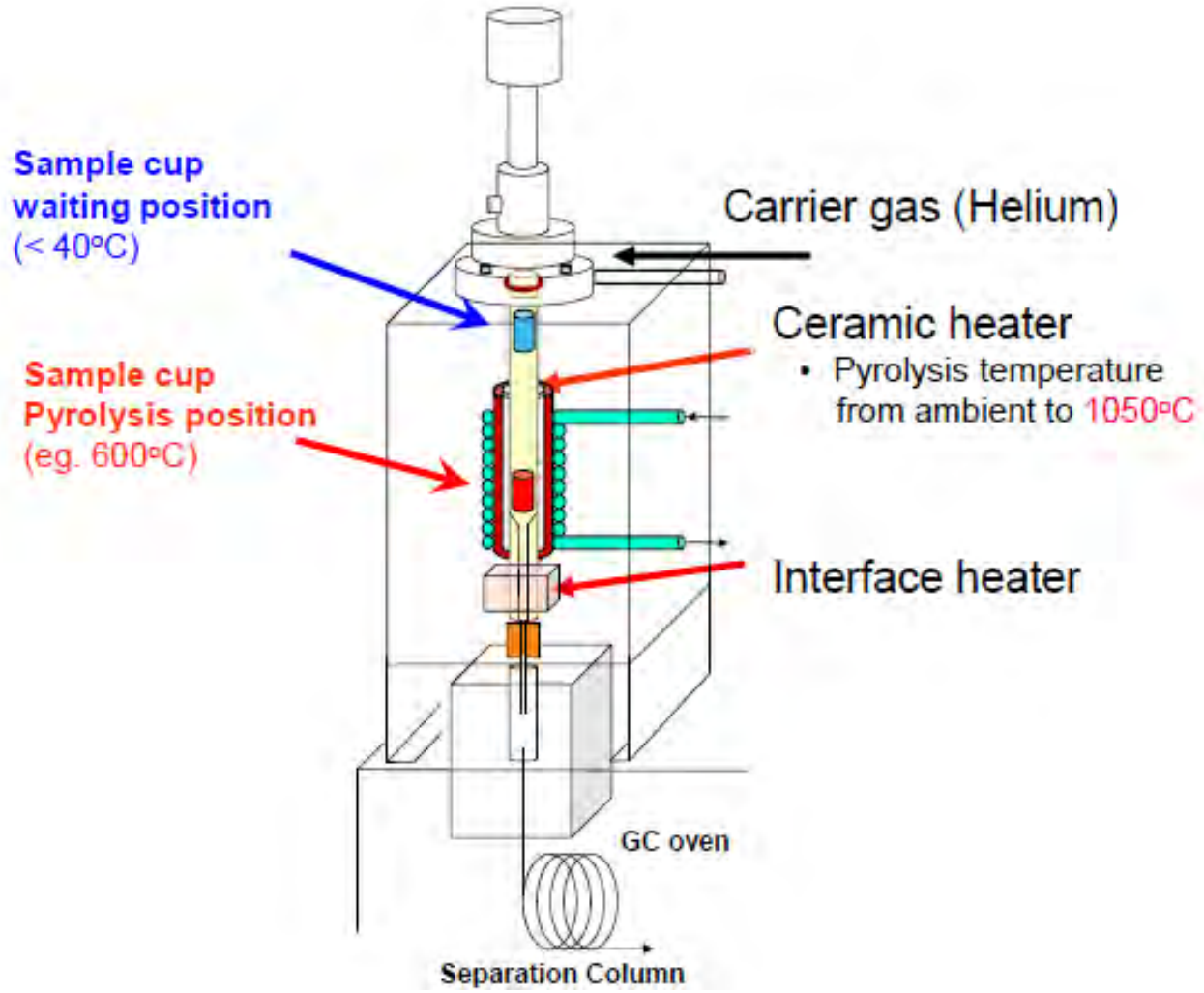
- สภาวะเครื่อง Pyrolyzer
- Single-Shot Analysis
- Furnace Temperature 600 °C
- Interface Temperature 300 °C

Sample cup

Sample preparation



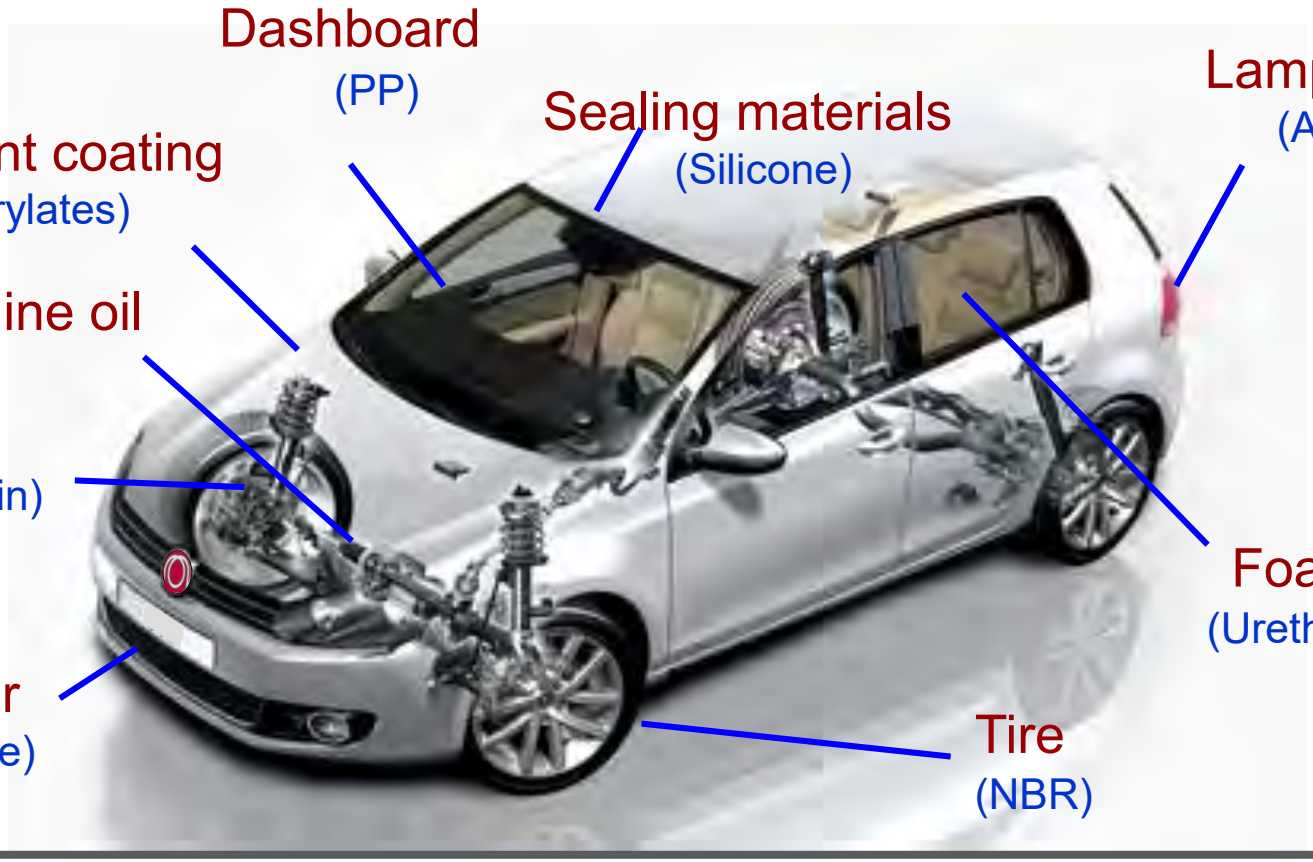
Schematic diagram of Multi-Shot pyrolyzer EGA/PY-3030D



Auto-Shot Sampler

- 48 samples
- Extremely Reliable
- Excellent Reproducibility

Typical polymeric samples from a car



Analysis of phthalate esters in PVC

- Thermal Desorption GC/MS has become an official method approved by IEC for the analysis of restricted phthalates in electrotechnical products Phthalates are widely used as plasticizers in manufacturing plastic products. With regard to additives in plastics used in electrical and electronic equipment, the maximum concentration of the restricted phthalates is **limited to 1000 ppm by the RoHS directive.**

- In March 2017, the thermal desorption GC/MS using a pyrolyzer was adopted as the official method and approved by IEC (International Electrotechnical Commission) for the analysis of certain phthalates in electrotechnical products regulated by the **RoHS directive (IEC 62321-8:2017).**

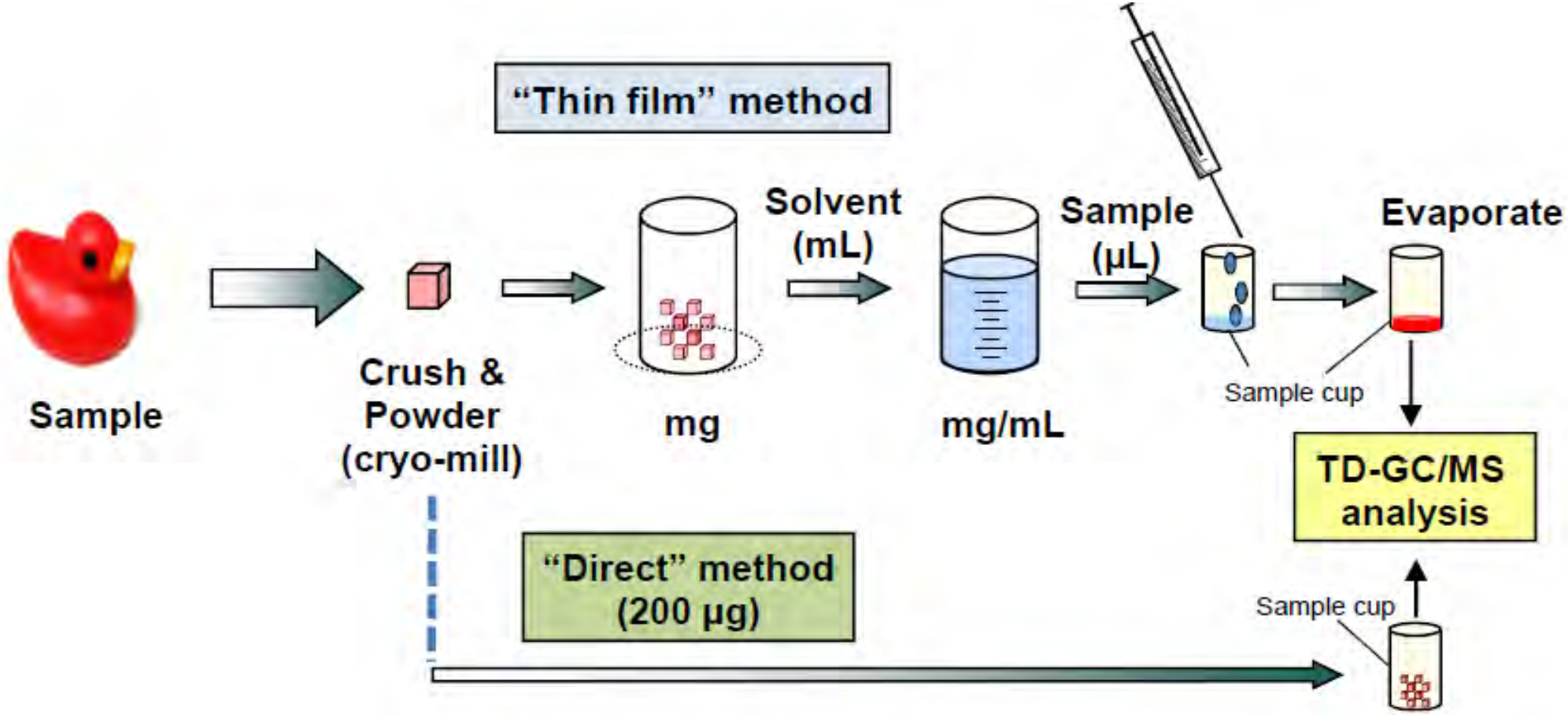
- The thermal desorption GC/MS method using Frontier Lab products complies with the IEC method.

A fast, easy and “green” thermal desorption-GCMS method for the analysis of phthalate esters in PVC

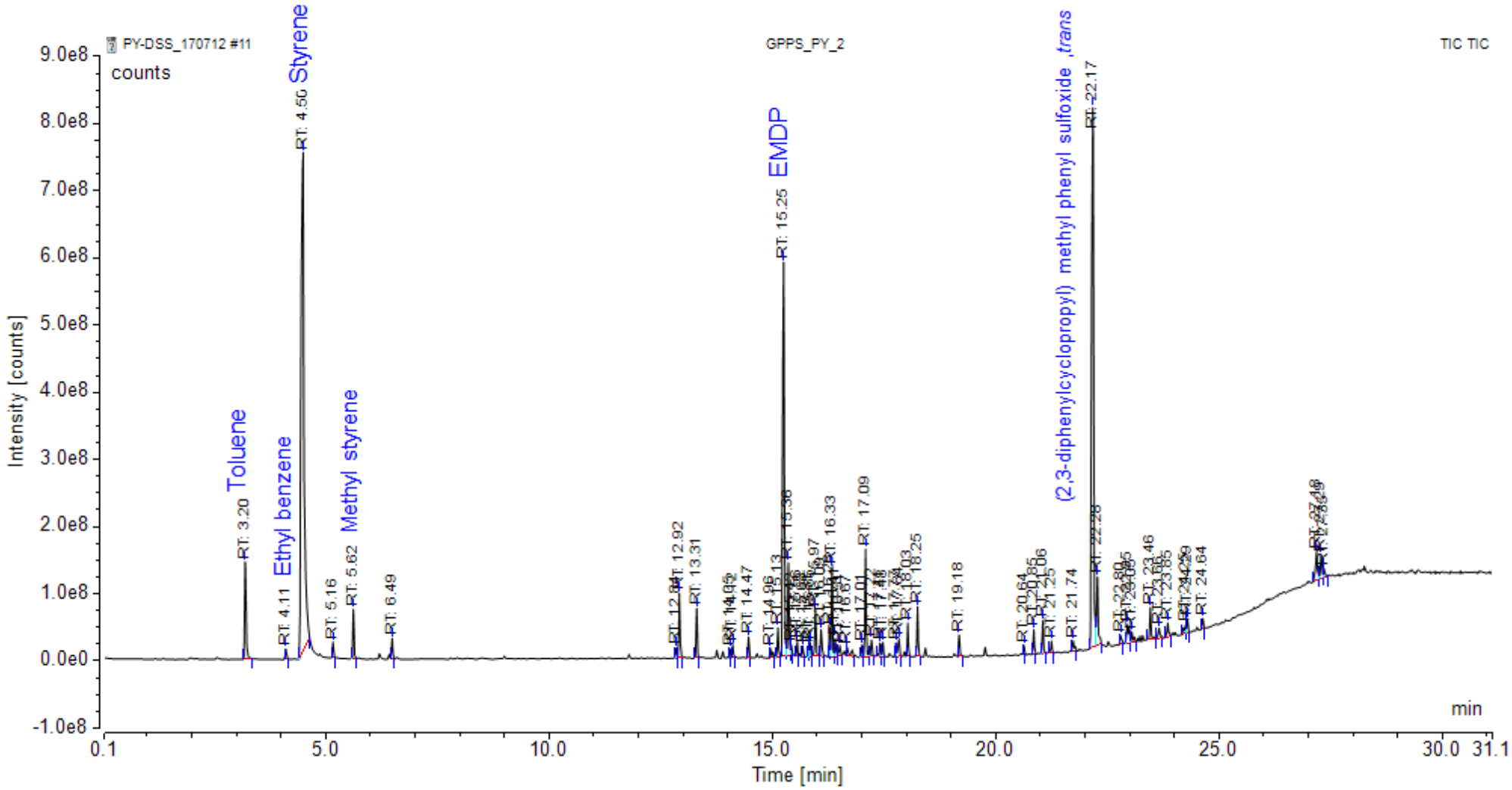
A discussion of the central factors that influence data quality when using ASTM D7823 for the determination of phthalates in polymeric substrates.

Thin Film method provides better quantitative results and sensitivity (due to more sample and homogeneity)

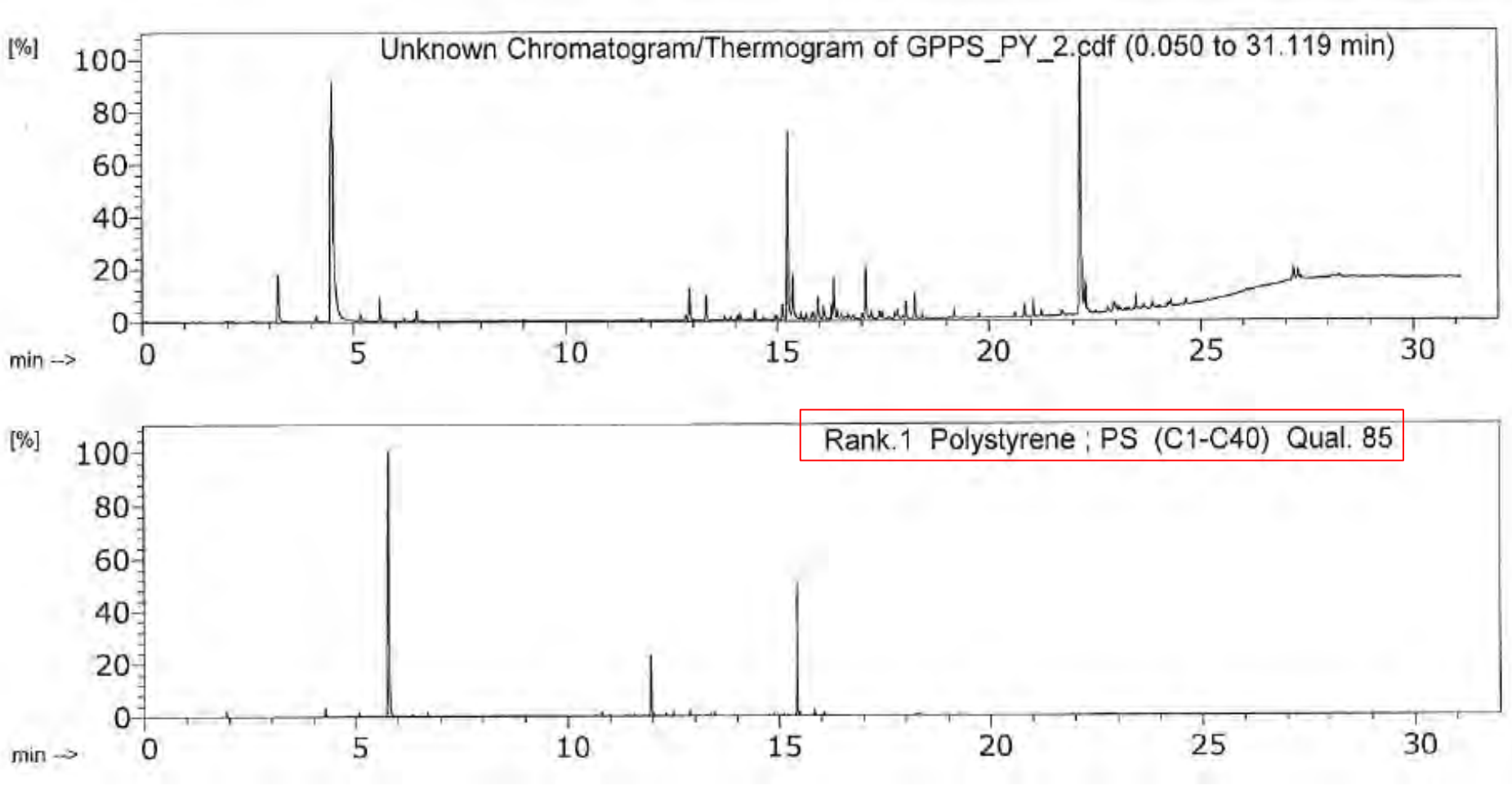
D.Randle, R.Freeman, A Hosaka and C. Watanabe Frontier Laboratories Ltd.



ผลการวิเคราะห์ตัวอย่างที่ 1



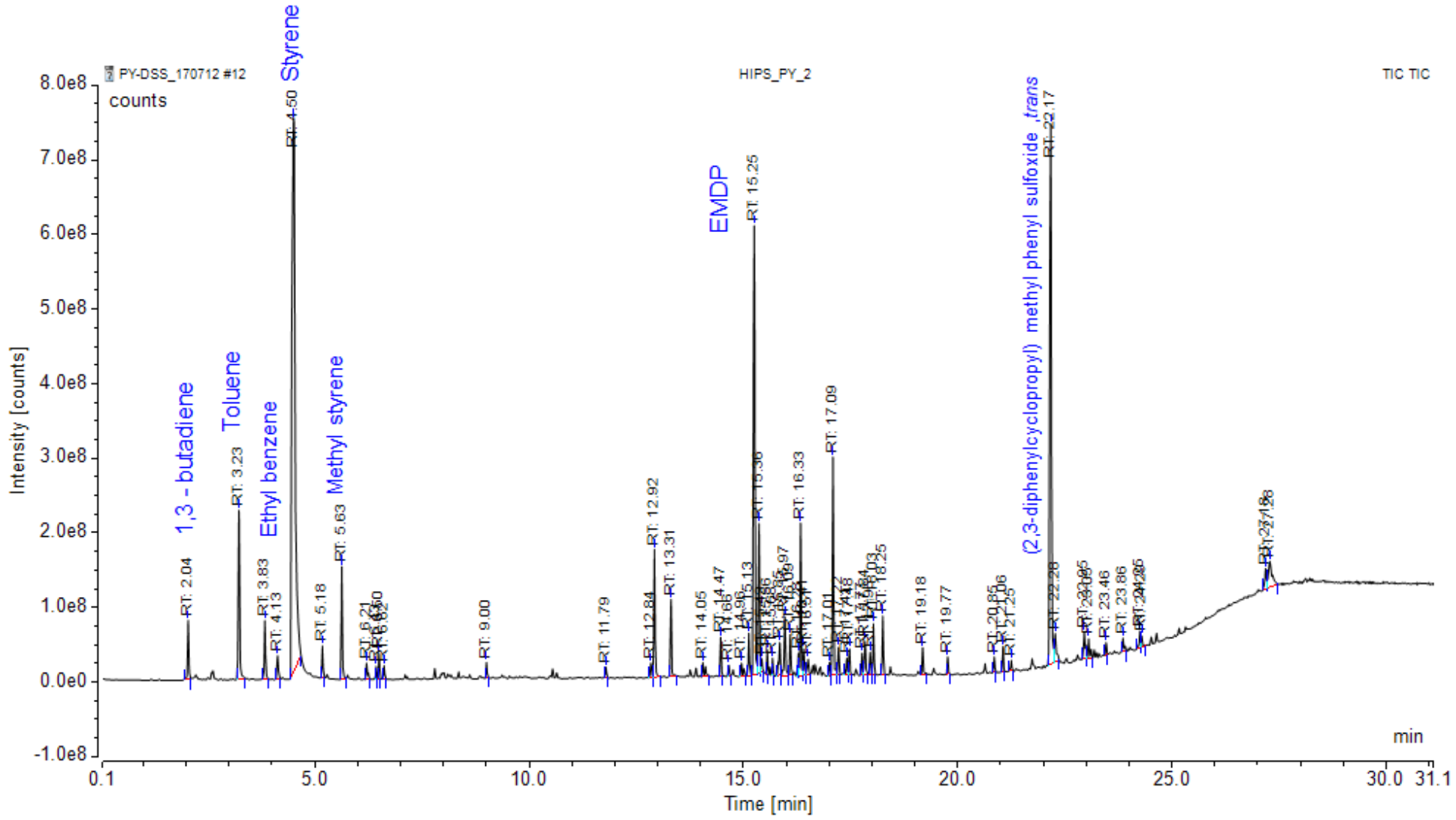
ผลการวิเคราะห์เมื่อเทียบกับฐานข้อมูลด้านพอมิเมอร์ผ่านซอฟแวร์ F-Search



Rank.2 : Styrene-butadiene copolymer ABA block, 85% styrene (C1-C40) Qual. 85

Rank.3 : Acrylonitrile-Butadiene-Styrene copolymer ; ABS (C1-C40) Qual.84

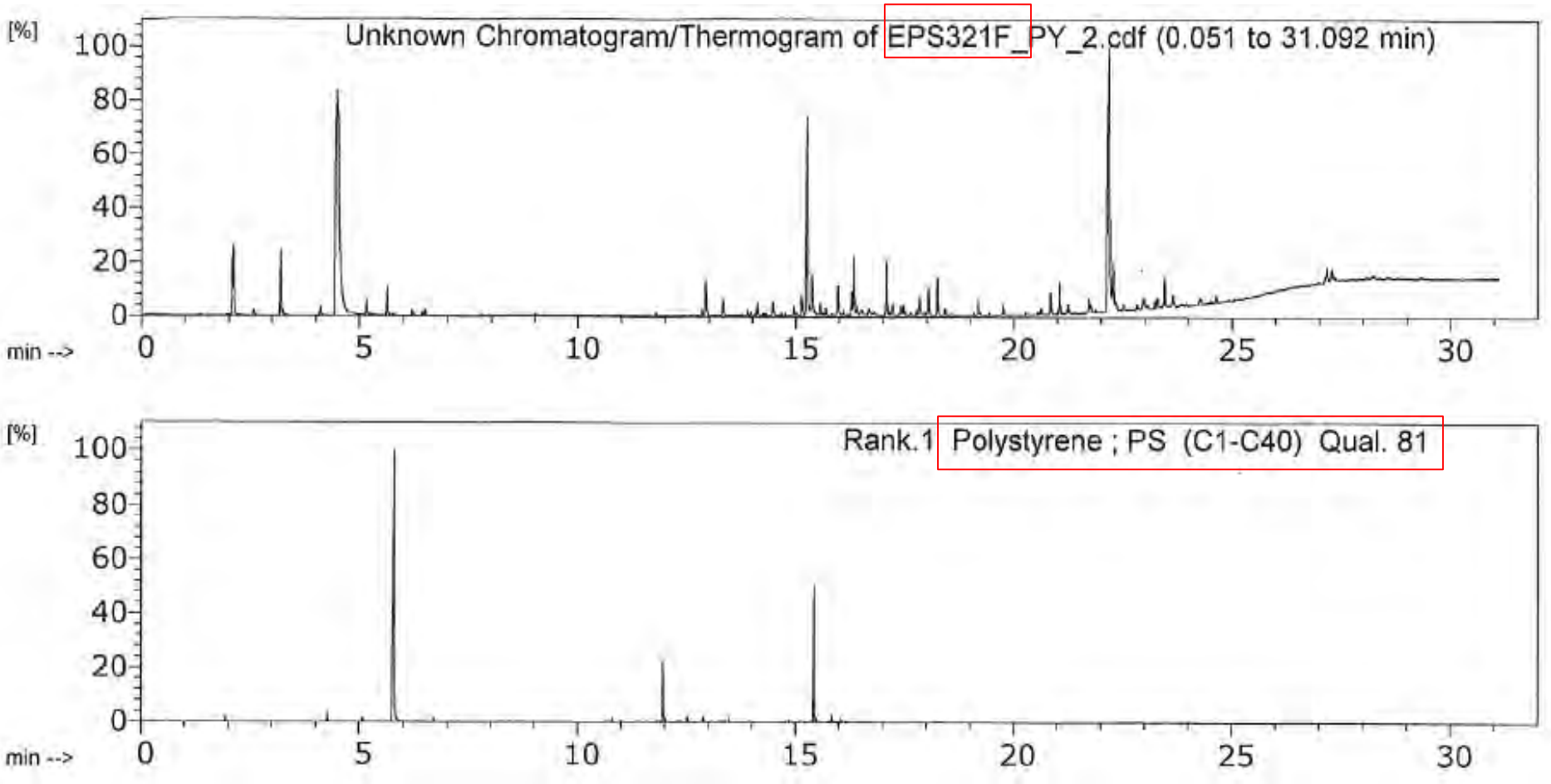
ผลการวิเคราะห์ตัวอย่างที่ 2



thermo scientific

SciSpec

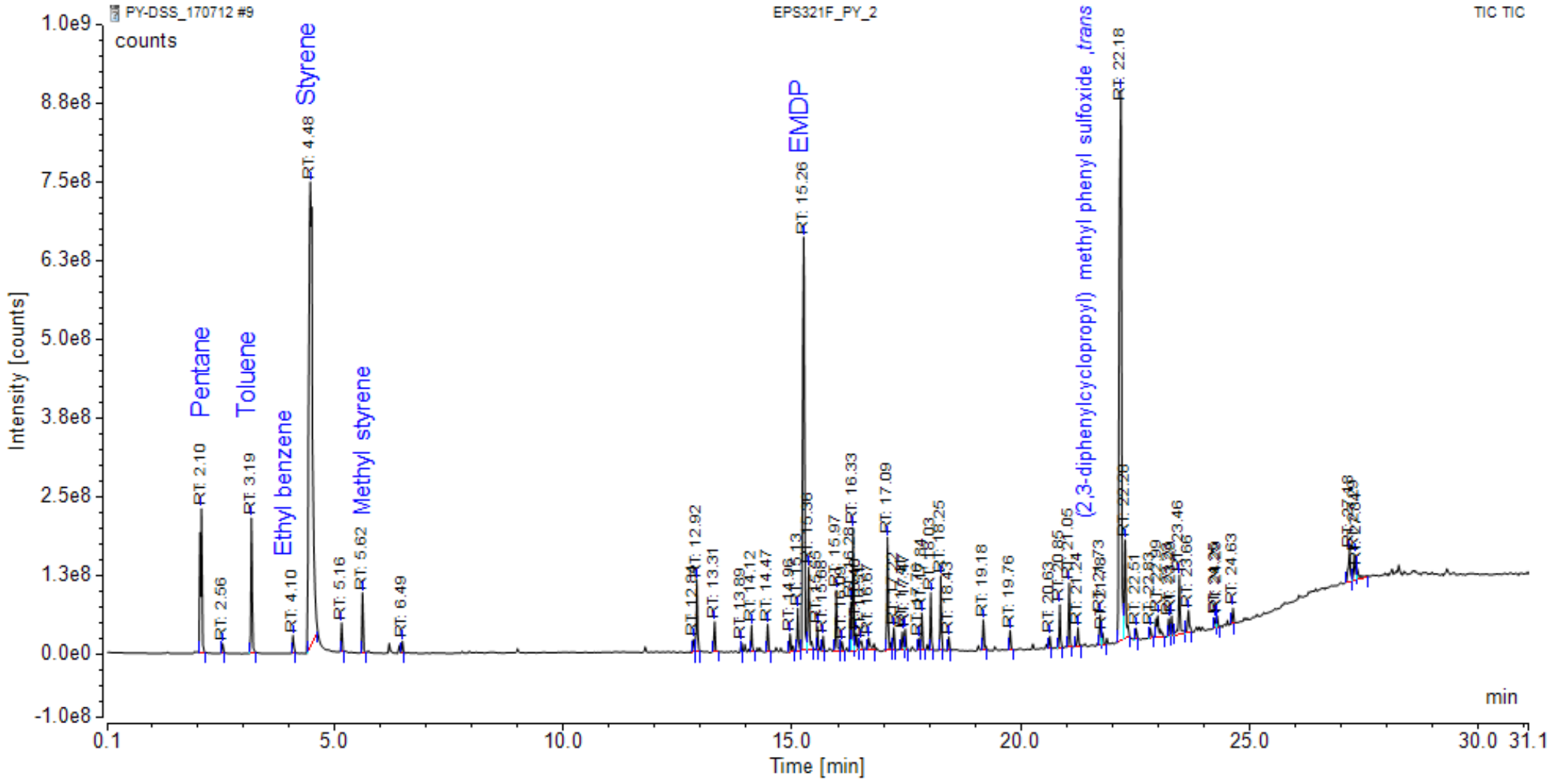
ผลการวิเคราะห์เมื่อเทียบกับฐานข้อมูลด้านพอมิเมอร์ผ่านซอฟแวร์ F-Search



Rank.2 : Acrylonitrile-Butadiene-Styrene copolymer ; ABS (C1-C40) Qual.81

Rank.3 : Styrene-butadiene copolymer ABA block, 85% styrene (C1-C40) Qual. 81

ผลการวิเคราะห์ตัวอย่างที่ 3



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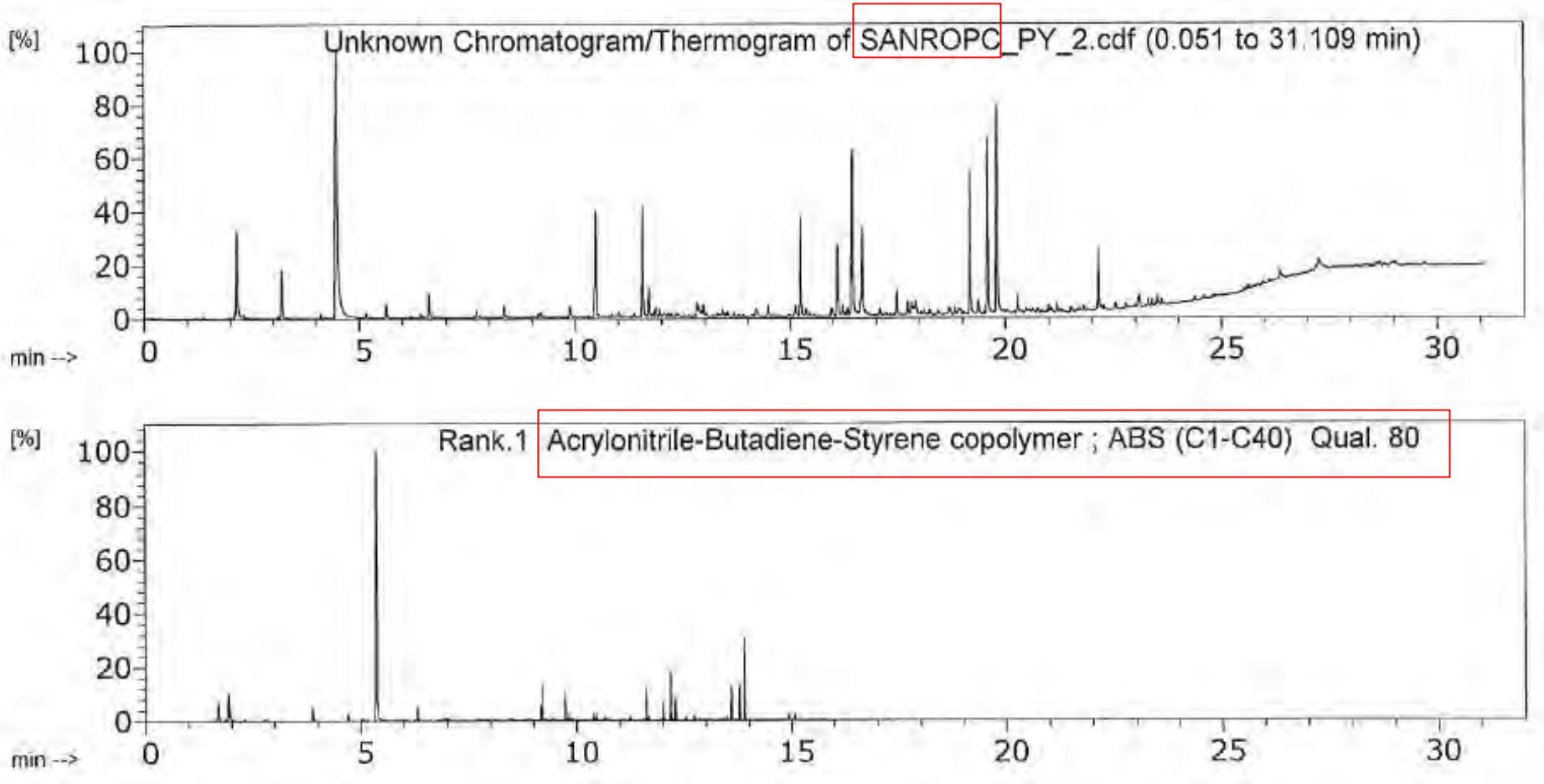
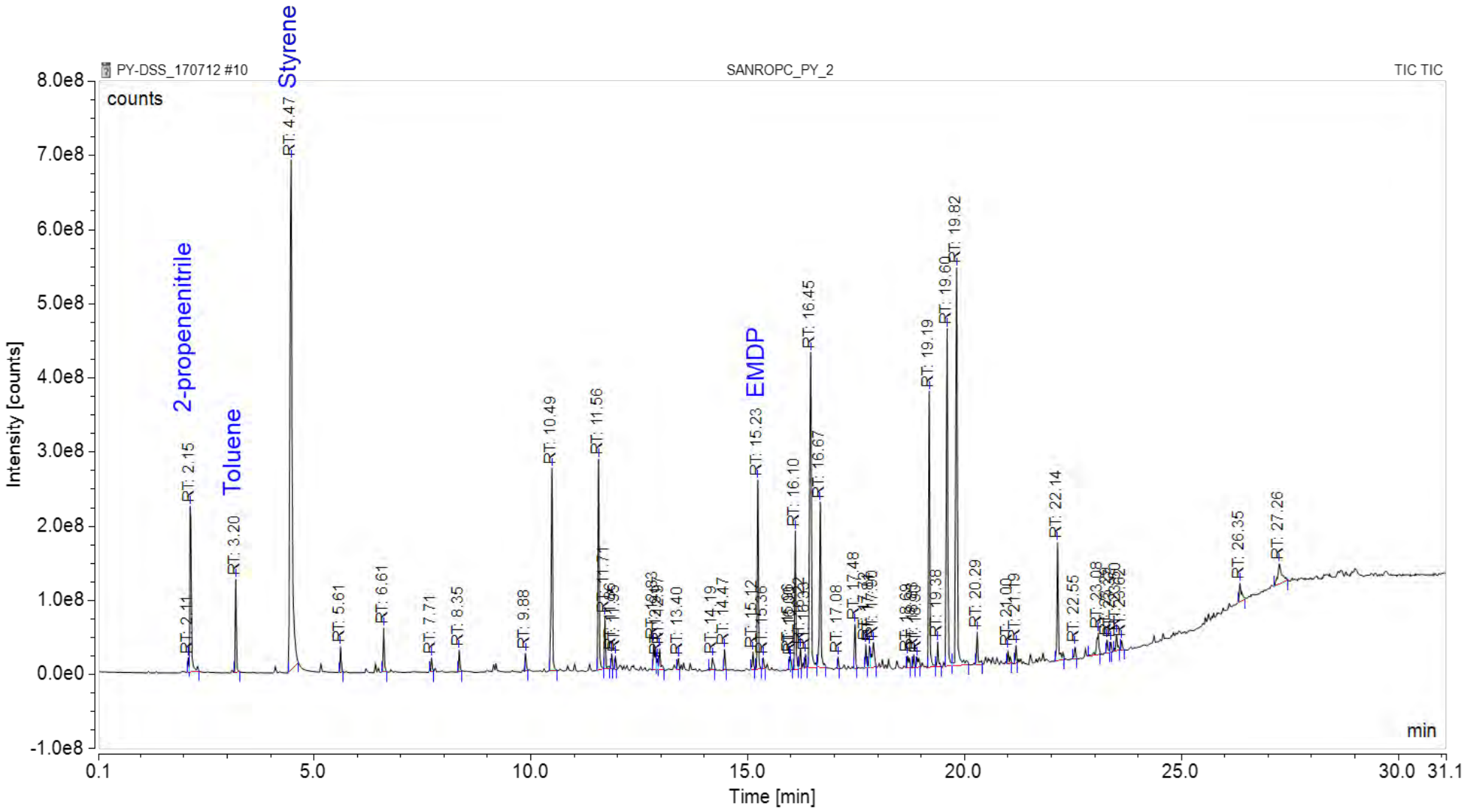


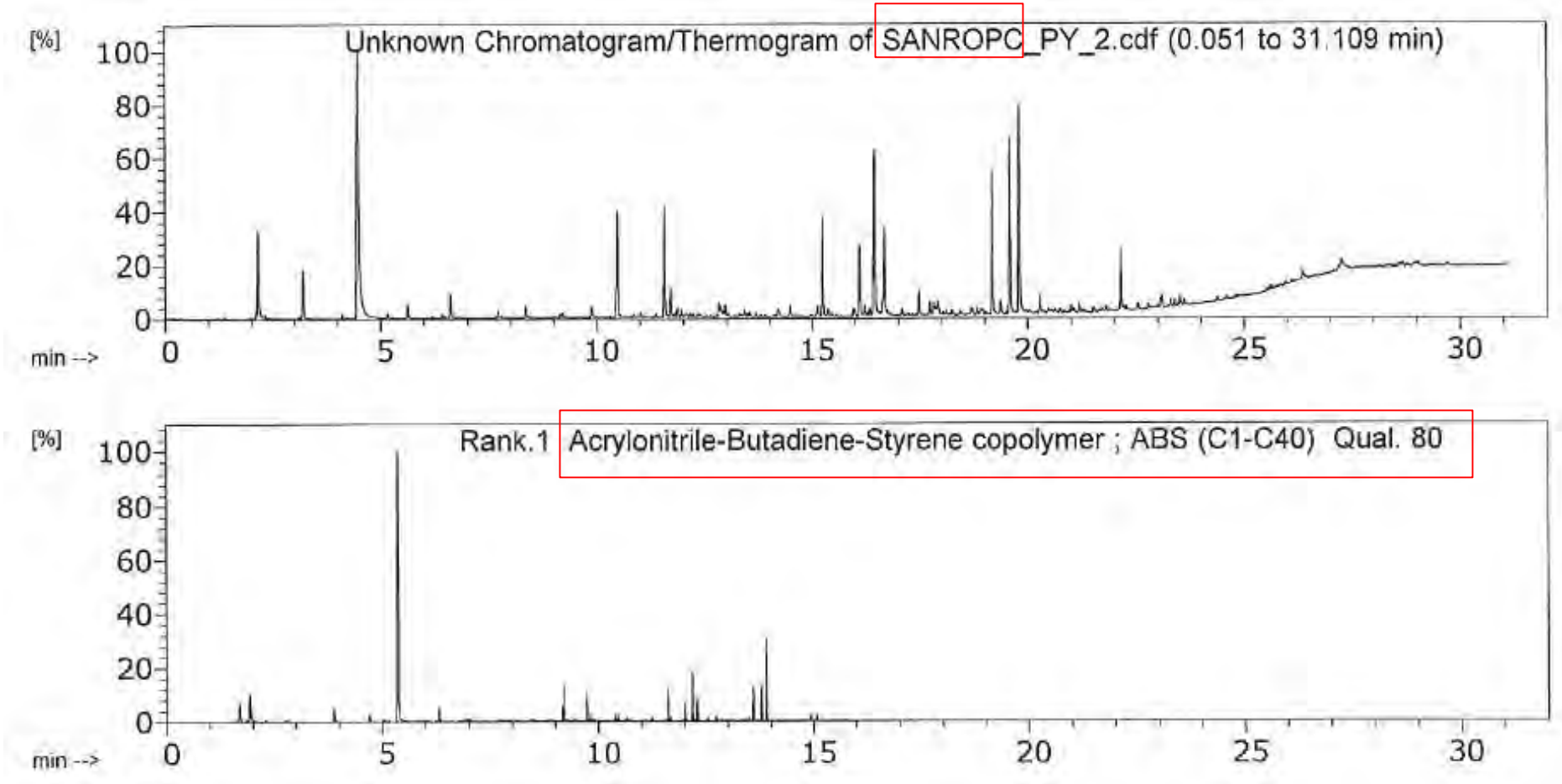
Rank.2 : Acrylonitrile-Butadiene-Styrene copolymer ; ABS (C1-C40) Qual.79

Rank.3 : Acrylonitrile styrene copolymer ; AS (C1-C40) Qual.76

ผลการวิเคราะห์ตัวอย่างที่ 4



ผลการวิเคราะห์เมื่อเทียบกับฐานข้อมูลด้านพอมิเมอร์ผ่านซอฟแวร์ F-Search

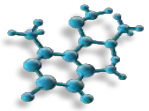


Rank.2 : Acrylonitrile-Butadiene-Styrene copolymer ; ABS (C1-C40) Qual.79

Rank.3 : Acrylonitrile styrene copolymer ; AS (C1-C40) Qual.76

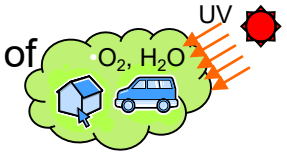
การประยุกต์ใช้ PY-GCMS

1: Characterization of polymers



2: Quality control

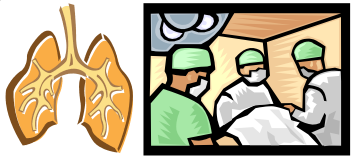
3: Degradation/life evaluation of polymeric materials



4: Recycling of polymeric materials, biomass utilization

5: Organic geochemistry and soil chemistry

6: Clinical science, pathology



7: Biochemistry, microbiology

8: Coal liquefaction, energy conservation

9: Forensic science

10: Wood science, pulp industry

11: Tobacco smoke, toxicology

12: Extraterrestrial science

13: Environmental science

ThermoFisher SCIENTIFIC

Analysis PAHs in extender oils

Scope for analysis.

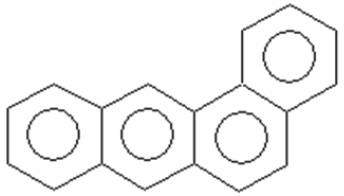
- EU standard specifies a procedure for determination of benzo(a)pyrene and sum of the eight individual polyaromatic hydrocarbons in extender oils. ***listed in Table1***
- Sample Preparation Method : BS EN 16143:2013

Name of PAH	Abbreviation	CAS Registry number
Benzo(a)pyrene	BaP	50-32-8
Benzo(e)pyrene	BeP	192-97-2
Benzo(a)anthracene	BaA	56-55-3
Chrysene	CHR	218-01-9
Benzo(b)fluoranthene	BbFA	205-99-2
Benzo(j)fluoranthene	BjFA	205-82-3
Benzo(k)fluoranthene	BkFA	207-08-9
Dibenzo(a,h)anthracene	DBahA	53-70-3

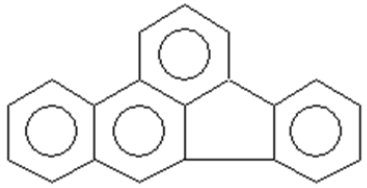
Table 1- List of individual PAHs in extender oils

PAHs...

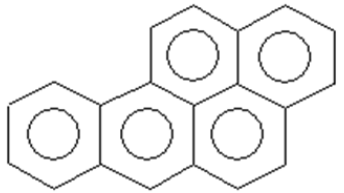
Consists of 8 natives of PAHs
MW range 228-278 amu (16PAHs could be up to 300+)



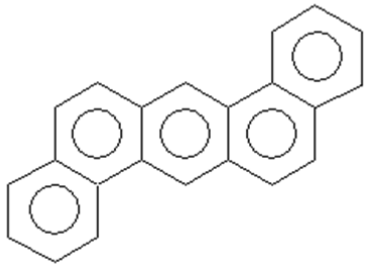
Benzo(a)anthracene



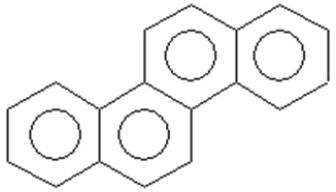
Benzo(b)fluoranthene



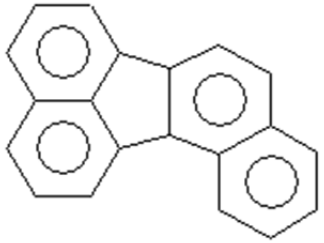
Benzo(a)pyrene



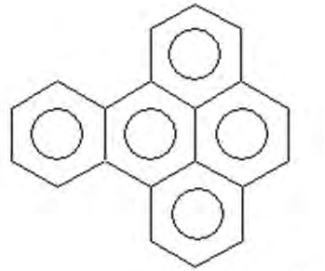
Dibenzo(a,h)anthracene



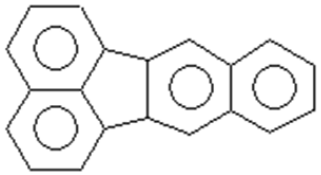
Chrysene



Benzo(j)fluoranthene



Benzo(e)pyrene



Benzo(k)fluoranthene

$C_{18}H_{12}$
MW. 228 g/mol

$C_{20}H_{12}$
MW. 252 g/mol

$C_{20}H_{12}$
MW. 252 g/mol

$C_{22}H_{14}$
MW. 278 g/mol

Sample Preparation Process

(1) Prepares sample solution

Weight Sample 70 ± 0.1 mg into Vol. flask 5 ml

Dissolve with 2 ml of n-Pentane and Spike internal Std. (deuterated IS)

(2) Deactivates silica

Deactivate Silica gel by stirring with 7% (m/m) of water for 24 h.

(3) 1st sample extraction (8 Hours)

3.1 Mix deactivated silica (in 2) 5 g with n-Pentane

*3.2 Load silica gel into chromatographic column (16 cm. L X 1 cm. ID)**

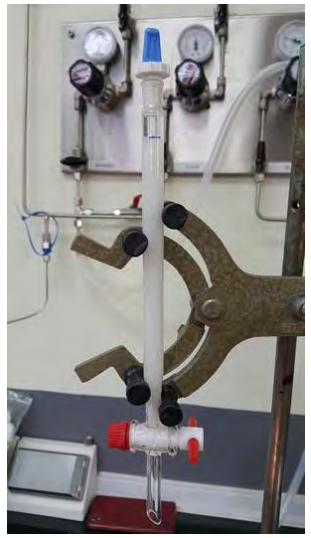
3.3 Flush silica gel with 10 ml n-Pentane through the column (discard)

3.4 Load sample (1) into column (before n-Pentane vanish form silica gel surface).

3.5 Rinse sample container with 2 ml n-Pentane.(not critical) and pour into column.

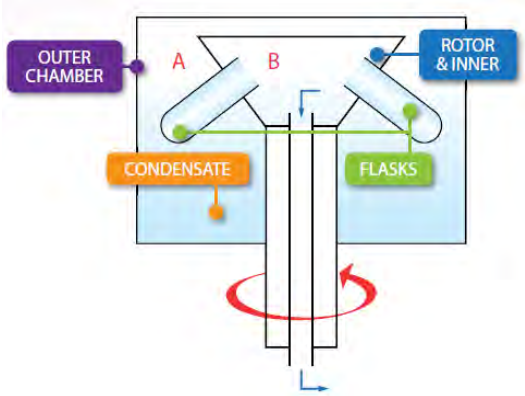
*3.6 Elute sample by Cyclohexane 75 ml (several portion) and collect the eluents.***

3.7 Evaporate eluent (3.6) under 35 C till final volume 1ml.



Pack column

Extracting



*extended lenth of column to 25 cm. convenient for sample loading

** pressurized with N2 (1 bar est.) for faster elution

Sample Preparation Process

(4) Sample clean up (Sephadex LH20) (6 hours)

4.1 Mix 5 g. of Sephadex with IPA .. leave for overnight.

4.2 Load Sephadex into chromatographic column (12 cm L X 2.3 cm ID)

4.3 Add 1 ml IPA into (3.7) and load into column.

4.4 Rinse sample vessel with IPA (1 ml) and load into column.

4.5 Elute with IPA at 1 ml/min, Discard the first 24 ml eluent.

4.6 Collect eluent portion (@24-70 ml) in drying vessel

4.7 Evaporate eluent (4.6) under 35 C till nearly dry.

4.8 Add 2 ml Acetone and evaporate till dry.

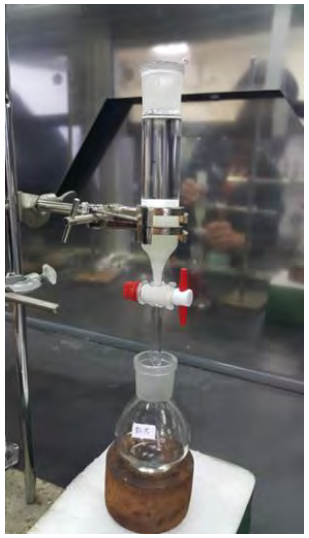
4.9 Dissolve with CycloC6 and transfer into 1 ml Vol.Flask

4.10 Add injection standard (DE) 0.2 ml and make up volume to 1 ml with CycloC6*

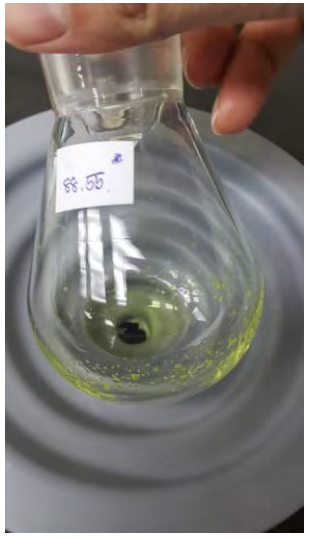
4.11 Make up volume to 1 ml wth Cyclohexane.

4.12 Analyze with GCMSMS.

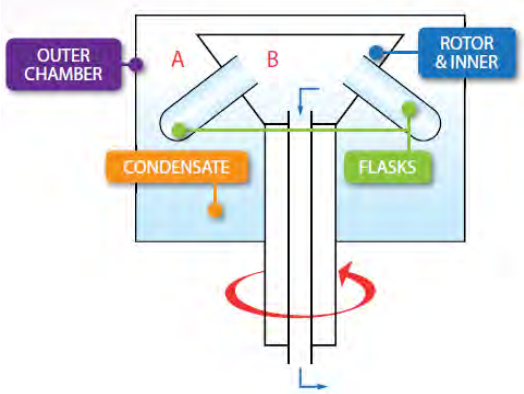
*DE = Decafluorodiphenyl



Fraction collecting



Dissolved Solution



GC parameters

Parameter	Value
GC-column	60 m x 0.25 mm ID x 0.25 µm
Stationary phase	17% phenyl-methylpolysiloxane
Temperature program	Initial 90 °C hold 1min 20°C /min to 250 °C 4°C /min to 330 °C hold 10 min
Injection	PTV, Splitless
Injection temperature	275 °C
Injection Volume	1 µL
Carrier gas	He UHP grade 1.2 ml/min

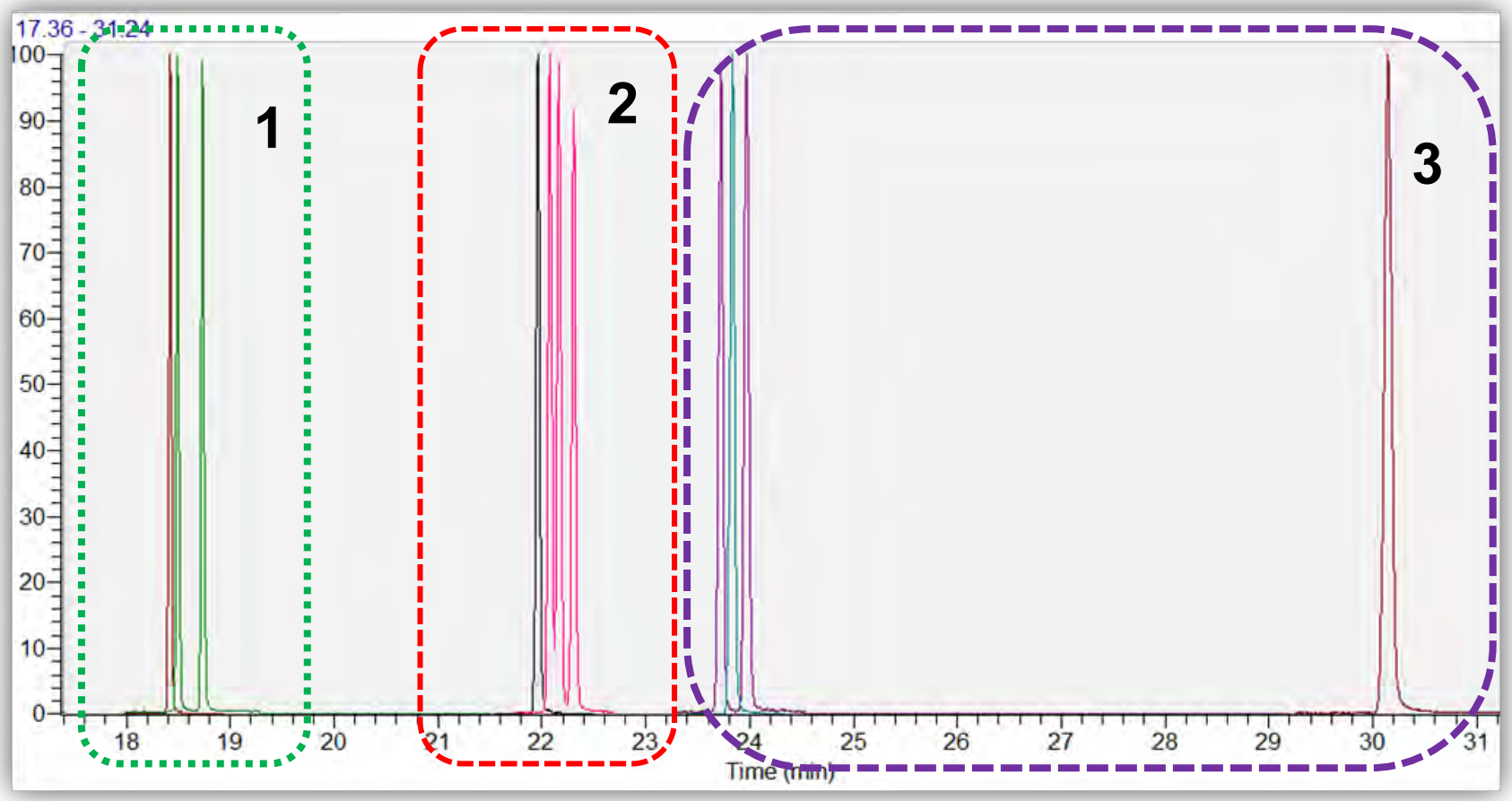
Instrument Method

- **Mass Spectrometer : EI – Temp 250 C/ TL Temp 330/**
- **MSMS –** SRM Q1 resolution 0.7 FWHM, Q3 Resolution 0.7 FWHM

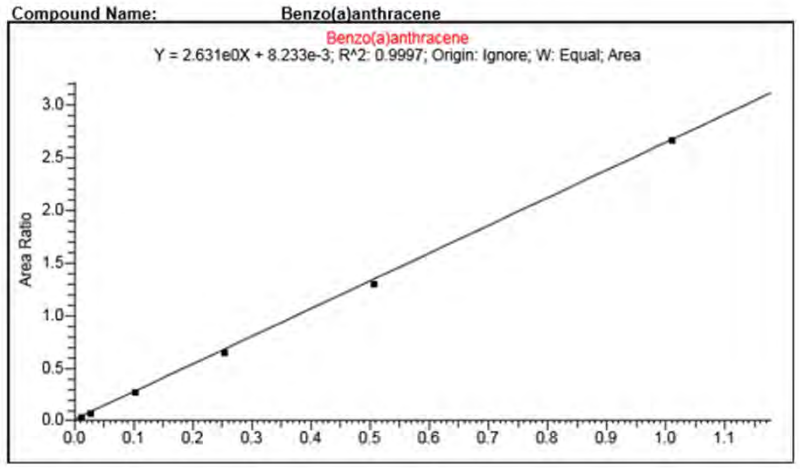
Component	RT	mass	product mass	Collision energy
Decfluorodiphynly	5.84	333.9	233.9	35
		333.9	264.9	25
Benzo(a)antracene-D12	18.46	240.1	212.1	25
		240.1	236	30
Benzo(a)antracene	18.53	228.1	202	25
		228.1	226	30
Chrysene	18.77	228.1	202	25
		228.1	226	30
Benzo(b)Fluoranthene-D12	22.02	264.1	236	30
		264.1	260	35
Benzo(b)fluoranthene	22.13	252.1	226	25
		252.1	250	30
Benzo(k)fluoranthene	22.22	252.1	226.1	25
		252.1	250	35
Benzo(j)fluoranthene	22.36	252.1	226	25
		252.1	250	30
Benzo(e)pyrene	23.78	252.1	226.1	30
		251.1	250	30
Benzo(a)pyrene-D12	23.89	264.2	236.1	30
		264.2	260	35
Benzo(a)pyrene	24.03	252.1	226.1	35
		251.1	250	30
Dibenzo(a,h)anthracene	30.23	278.1	276	35
		278.1	276.2	50

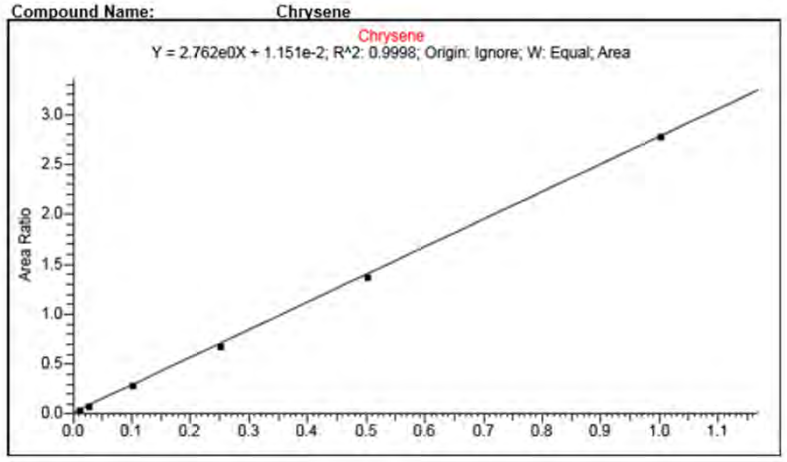
8 PAHs Standard

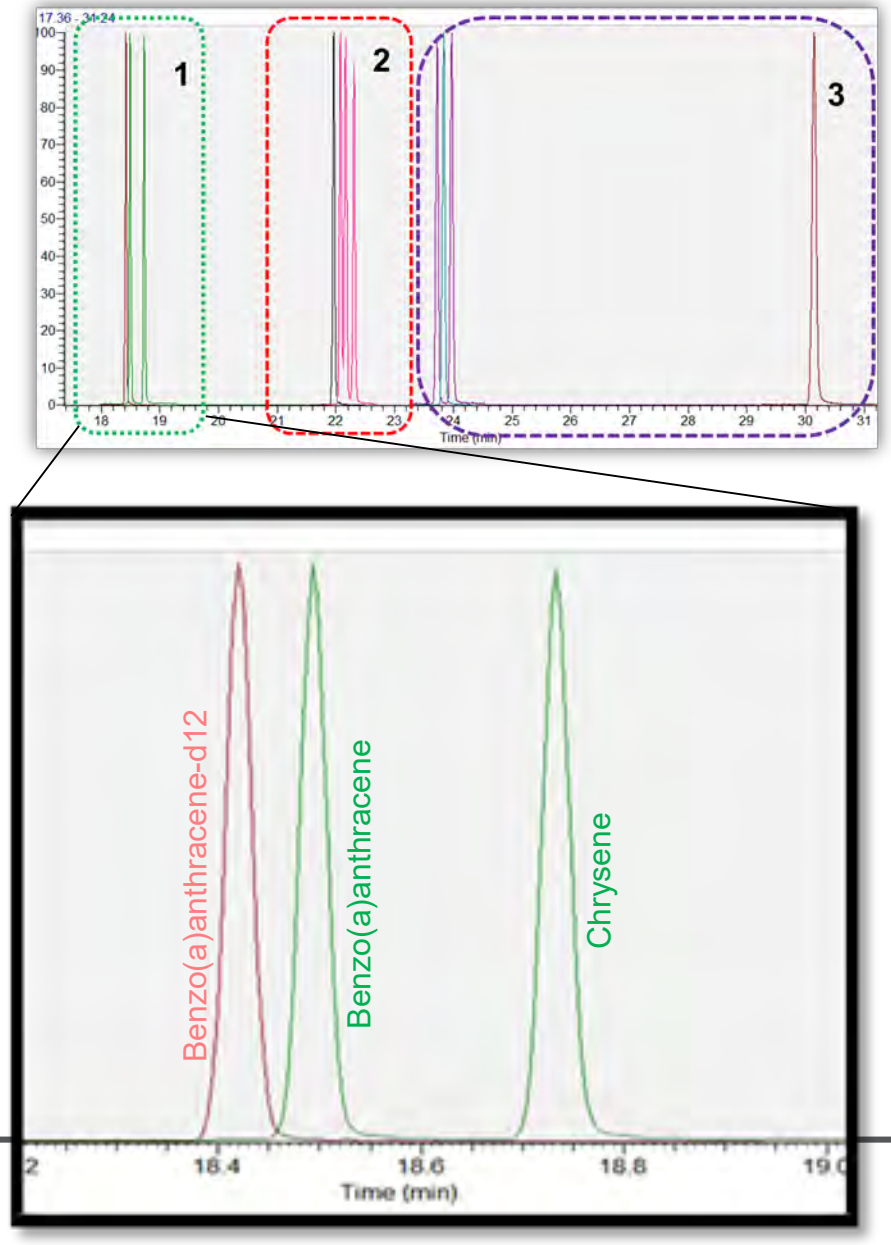
TIC



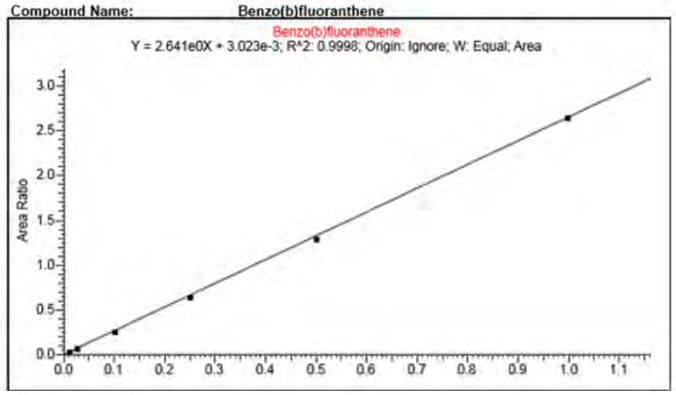
Chromatogram (1) –Standard 8 PAHs with 3 IS(d12)

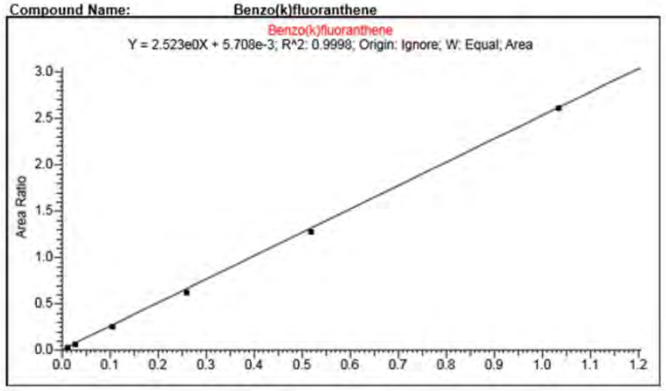


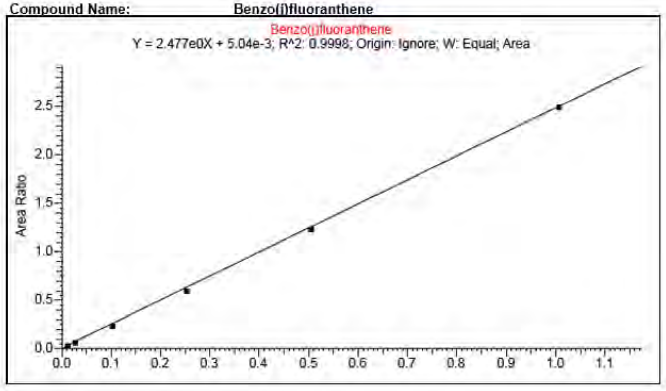


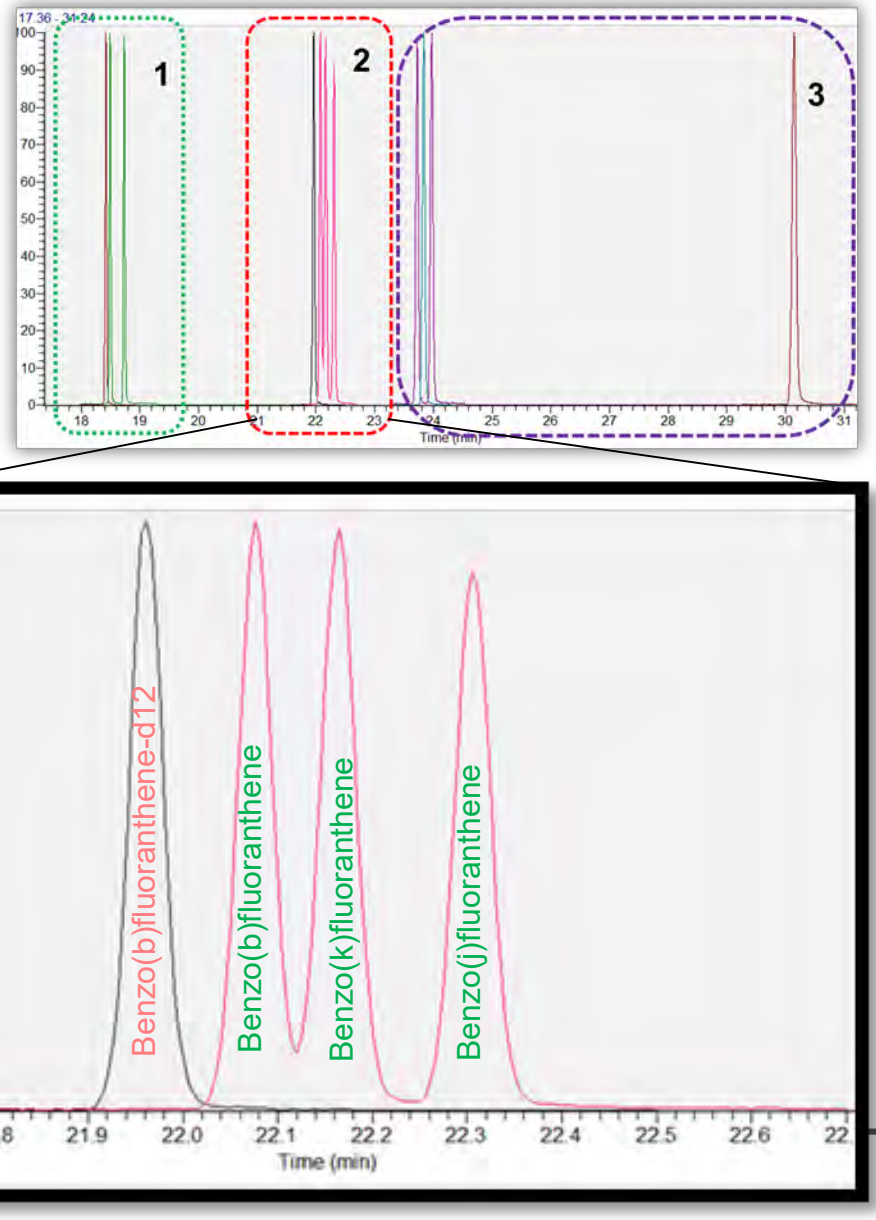


Chromatogram (2) –Standard 8 PAHs with 3 IS(d12)

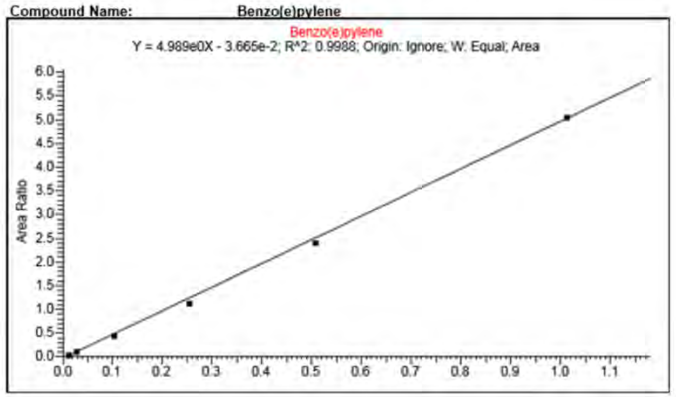


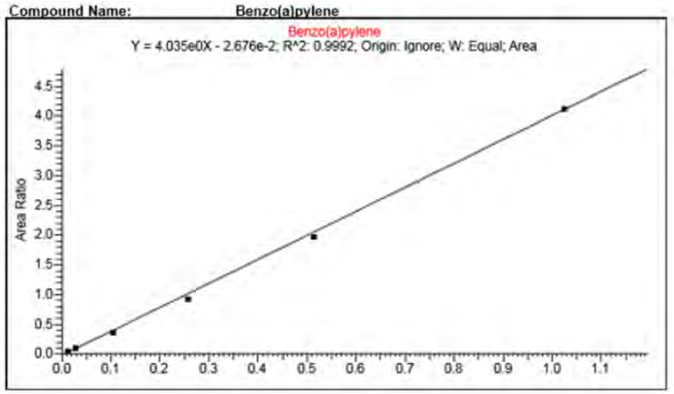


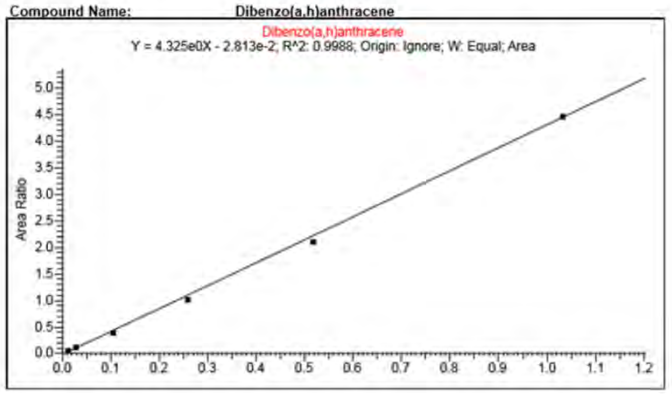


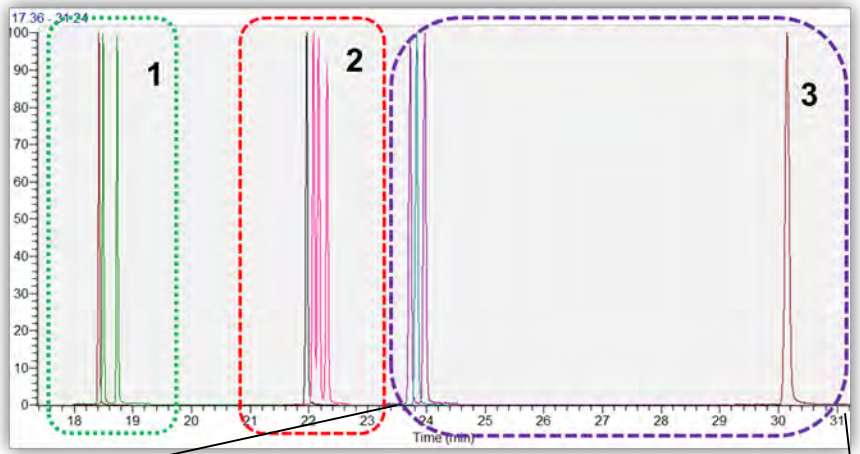


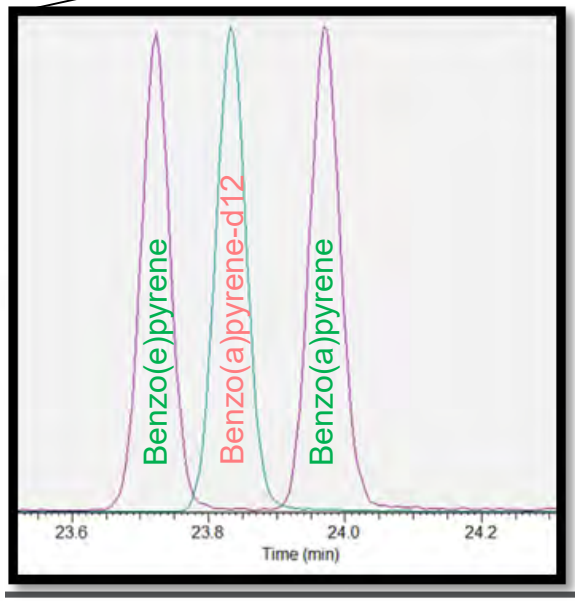
Chromatogram (3) –Standard 8 PAHs with 3 IS(d12)

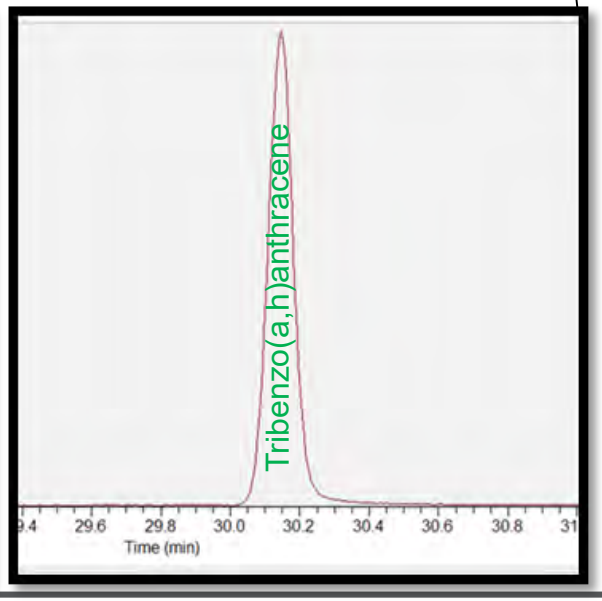












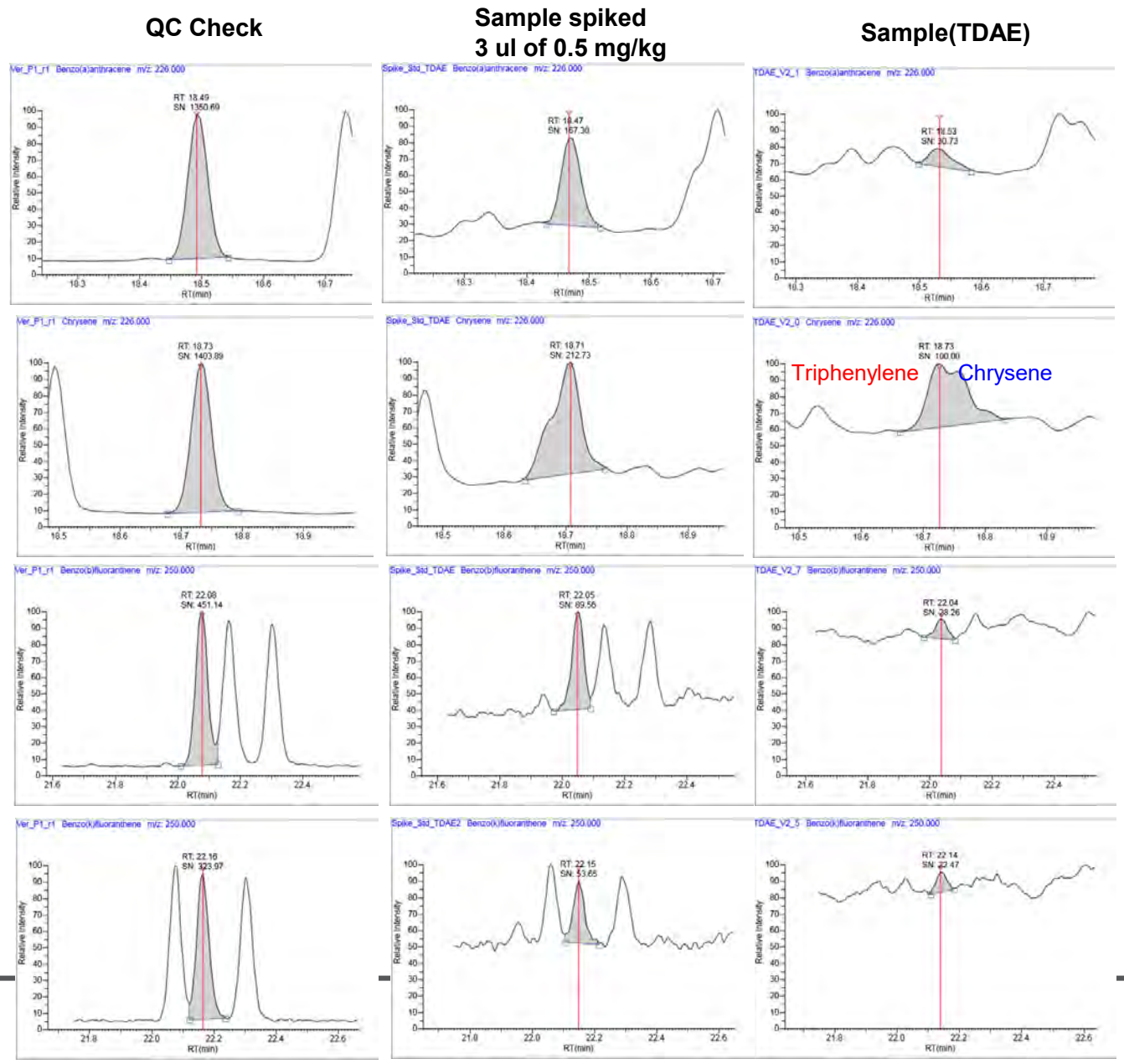
LOD/LOQ

- Calculated from 10 replicate runs of TDAE sample (Treated Distillate Aromatic Extracted)

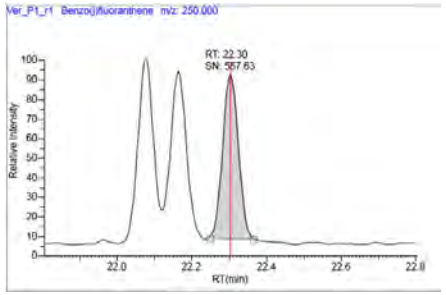
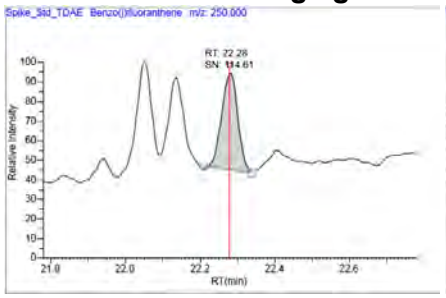
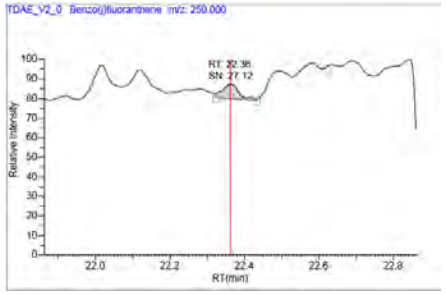
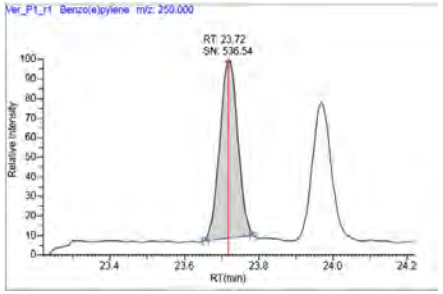
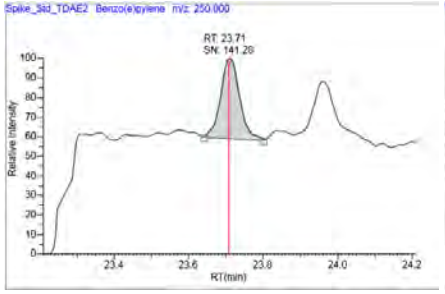
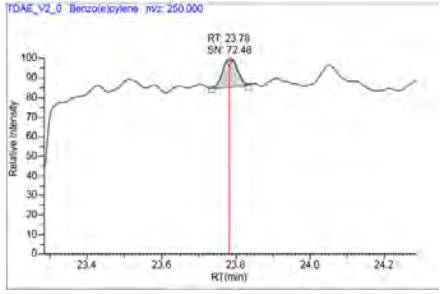
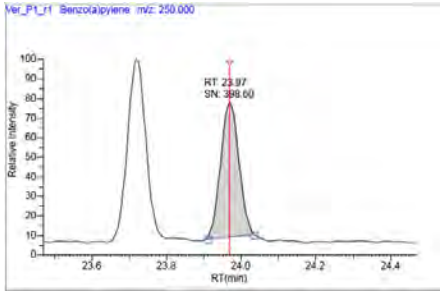
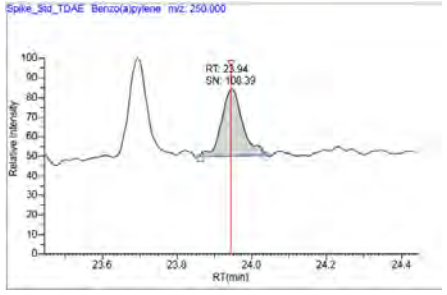
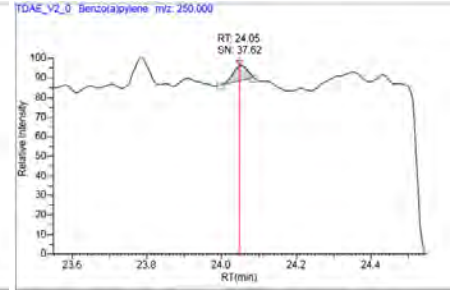
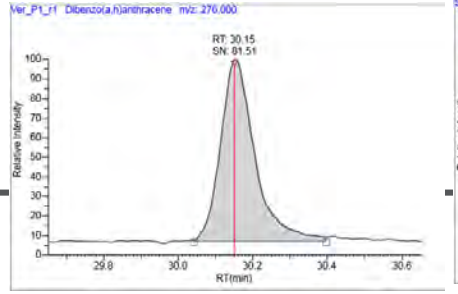
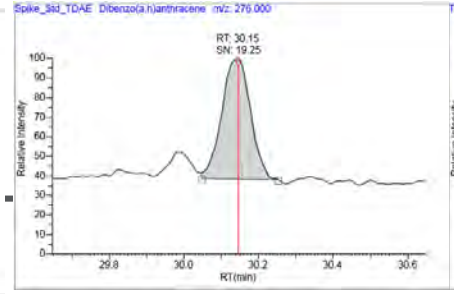
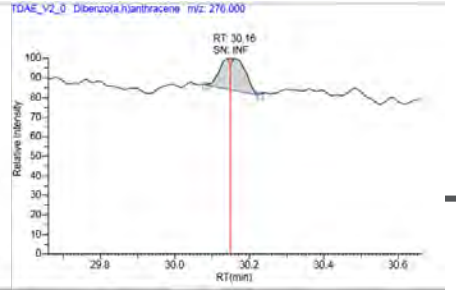
No.	PAHs (mg/kg)							
	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(j)fluoranthene	Benzo(e)pylene	Benzo(a)pylene	Dibenzo(a,h)anthracene
1	0.226	0.370	0.198	0.186	0.103	-0.507	0.144	0.125
2	0.220	0.367	0.177	0.165	0.117	-0.510	0.130	0.148
3	0.222	0.361	0.184	0.182	0.127	-0.507	0.137	0.124
4	0.236	0.375	0.194	0.178	0.136	-0.511	0.147	0.149
5	0.221	0.372	0.204	0.168	0.118	-0.518	0.129	0.150
6	0.224	0.366	0.189	0.180	0.117	-0.510	0.129	0.142
7	0.236	0.363	0.192	0.194	0.123	-0.535	0.122	0.139
8	0.221	0.368	0.204	0.178	0.133	-0.509	0.126	0.135
9	0.247	0.369	0.181	0.166	0.118	-0.509	0.125	0.144
10	0.231	0.362	0.202	0.169	0.130	-0.507	0.115	0.147
SD	**0.0089**	**0.0045**	**0.0097**	**0.0095**	**0.0097**	**0.0086**	**0.0098**	**0.0095**
LOD	**0.0267**	**0.0134**	**0.0291**	**0.0285**	**0.0291**	**0.0258**	**0.0294**	**0.0286**
LOQ	**0.0891**	**0.0447**	**0.0969**	**0.0951**	**0.0972**	**0.0860**	**0.0980**	**0.0955**

8 compounds of PAHs have LOQ less than 0.1 mg/kg

Peak Confirmation



Peak Confirmation

	QC Check	Sample spiked 3 ul of 0.5 mg/kg	Sample-TDAE
Benzo(j)fluoranthene			
Benzo(e)pyrene			
Benzo(a)pyrene			
Dibenzo(a,h)anthracene			

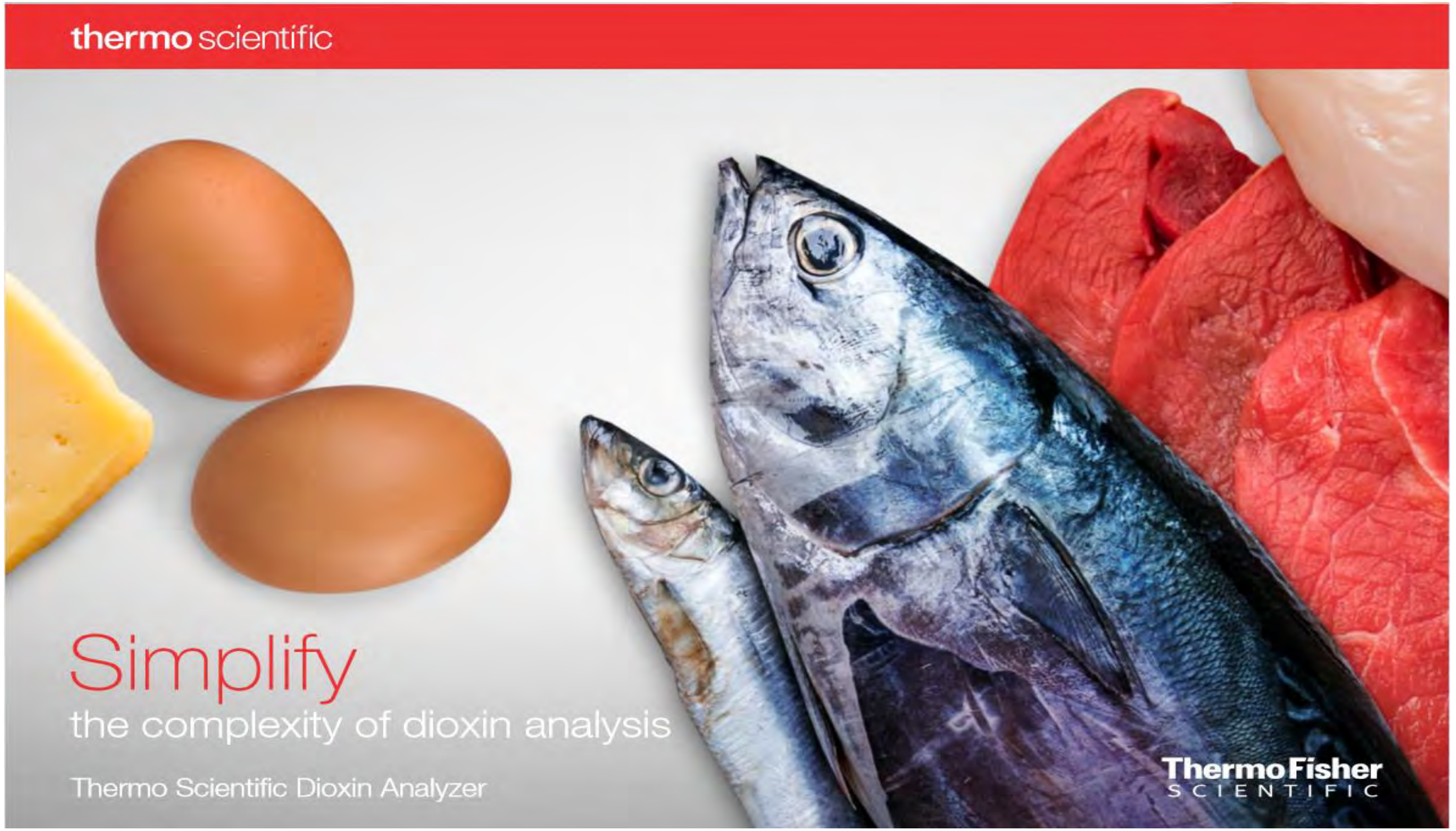
Result.. Recovery

- Two batches of analysis (2 replicates for each batch) from same sample (RPO)
- Recovery of PAHs : Deuterated IS vs. Injection Standard (Decafluorodiphenyl)
- BIU acceptable recovery is between 50% and 150%

Internal standard	Standard amount (mg)	Sample		Calculated amount (mg)	%Recovery	Acceptable Criteria of %Recovery	Verified
		RPO_V1_Re01	RPO_V1_Re02				
Benzo(a)anthracene-d12	4008	4663.572	4719.434	4691.503	117.05	(50-150)	Pass
Benzo(b)fluoranthene-d12	4216	5684.548	5493.625	5589.087	132.57	(50-150)	Pass
Benzo(a)pyrene-d12	4060	5389.764	5301.968	5345.866	131.67	(50-150)	Pass
		RPO_V2_Re01	RPO_V2_Re02				
Benzo(a)anthracene-d12	4008	3532.543	3532.543	3532.543	88.14	(50-150)	Pass
Benzo(b)fluoranthene-d12	4216	3249.254	3249.254	3249.254	77.07	(50-150)	Pass
Benzo(a)pyrene-d12	4060	3319.878	3319.878	3319.878	81.77	(50-150)	Pass

Comments

- Complicated & time consuming sample preparation – requires skills and prone to error
- Improvement in separation (triphenylene vs. chrysene) can be done upon availability of standard (triphenylene).
- Comparison study of purification between the two steps i.e. Silica Gel vs. Silica Gel & Sephadex are not so much different.
- New development on sample prep in order to reduce work loads and improve analysis result.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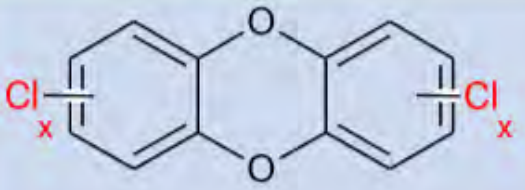
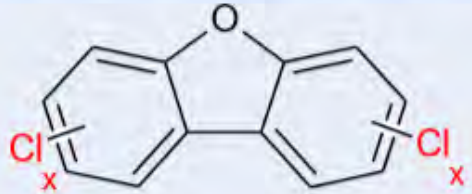
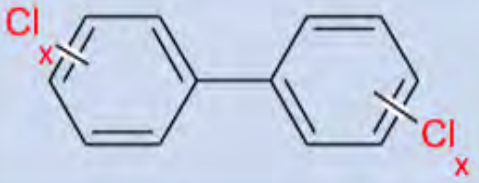
Simplify
the complexity of dioxin analysis
Thermo Scientific Dioxin Analyzer
ThermoFisher
SCIENTIFIC

Introduction to Dioxin & Dioxin Like PCBs

- Identified as toxic by the United Nations due to adverse effects on humans and the ecosystem
- The Stockholm agreement was signed in 2001 and entered into EU Legislation in 2004
- Of the possible 419 PCDD, PCDF and PCB congeners only 29 are recognised as toxic, but each have differing toxicity
- Most toxic: 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

- Up to 2012 only Magnetic Sector GC-HRMS was acceptable for analysis

Structure	Abbreviation	# Toxic Congeners
	PCDD	7
	PCDF	10
	PCB	12

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Thermo Scientific™ Dioxin Analyzer

The Thermo Scientific™ Dioxin Analyzer is an integrated, sample-to-result GC-MS/MS based, easy to implement, analytical workflow developed to deliver robust and sensitive quantitation of polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzo furans (PCDF) and dioxin-like polychlorinated biphenyls (dl-PCBs), in food and feed samples in compliance with the latest EU regulations (EU Regulation 664/2017).

SAMPLE PREPARATION

Tools to accelerate sample preparation

Automated micro-sampling and injection of small volumes of extracts

SEPARATION

TG-Dioxin column with unique selectivity for toxic dioxin and furan congeners

Separation of critical pairs

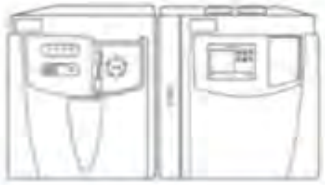
Quality check standards included to verify performance criteria

DETECTION

TSQ 9000 with AEI source

Pre optimized SRM transitions

Segmented or time acquisition method



DATA MANAGEMENT

Compliant-ready data processing

Automatic calculation of TEQ results built into Chromeleon software

Reporting templates with isotope standards recovery, ion ratio, LOQ flagging and other extensive functionality

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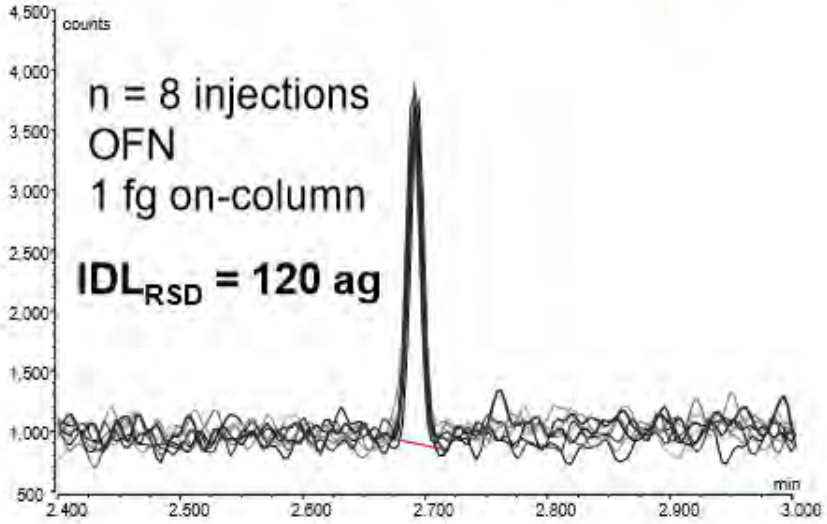
Features and Benefit of TSQ 9000 AEI

TSQ 9000 Triple Quadrupole GC-MS/MS system with AEI source

Feature	Benefit
Highly efficient ionization	A greater ion flux reaching the detector
A more tightly focused ion beam	Less ion burn and a higher degree of robustness

Thermo Scientific™ Advanced Electron Ionization (AEI) source



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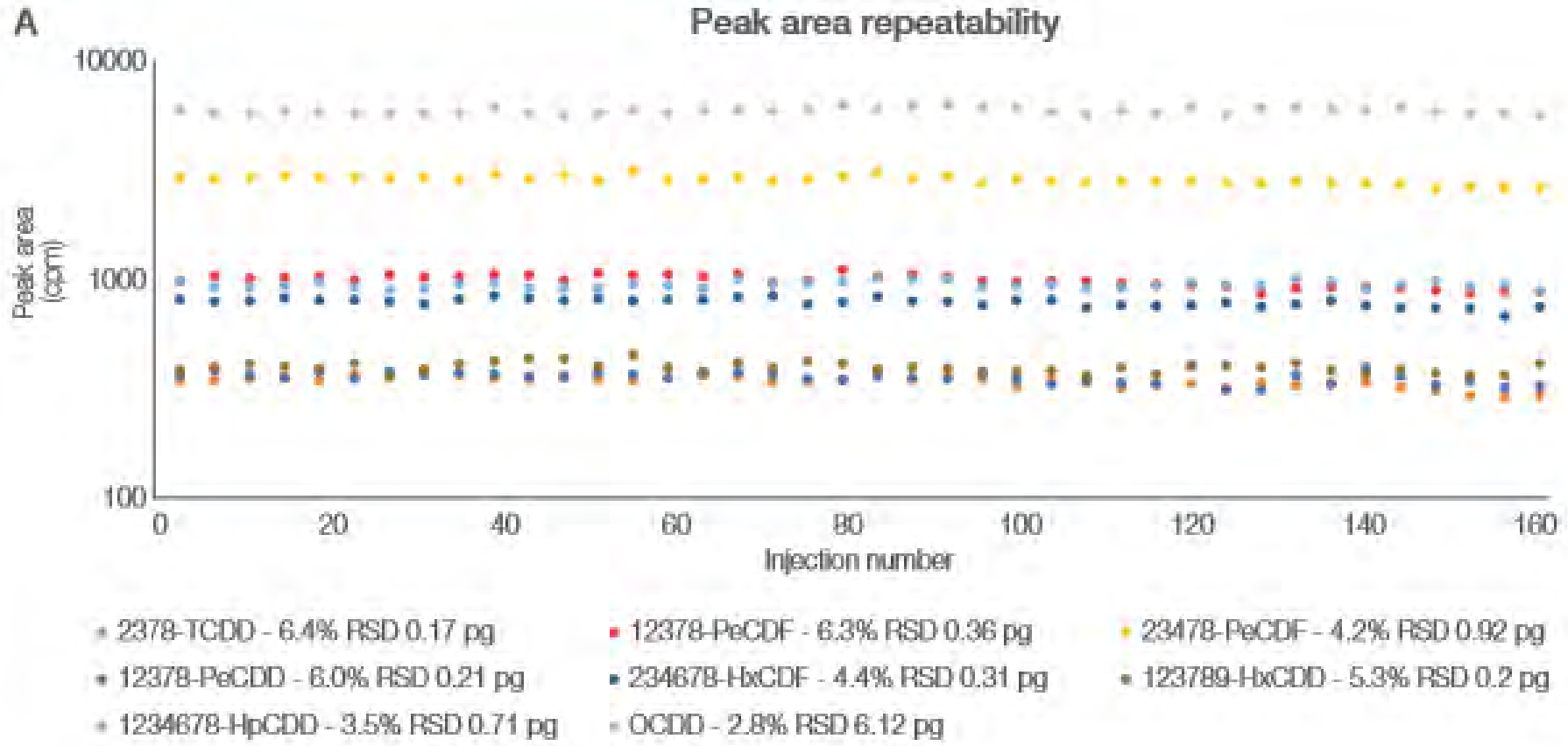
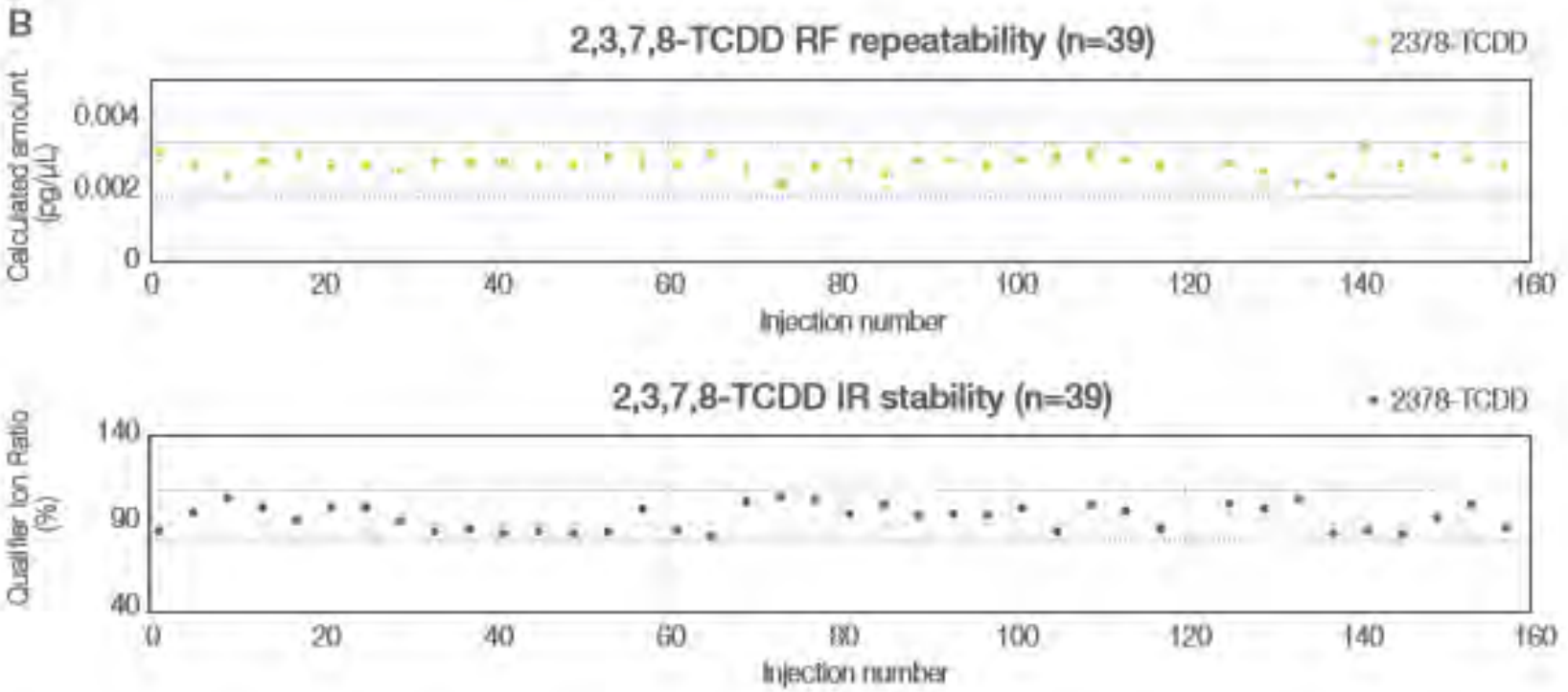
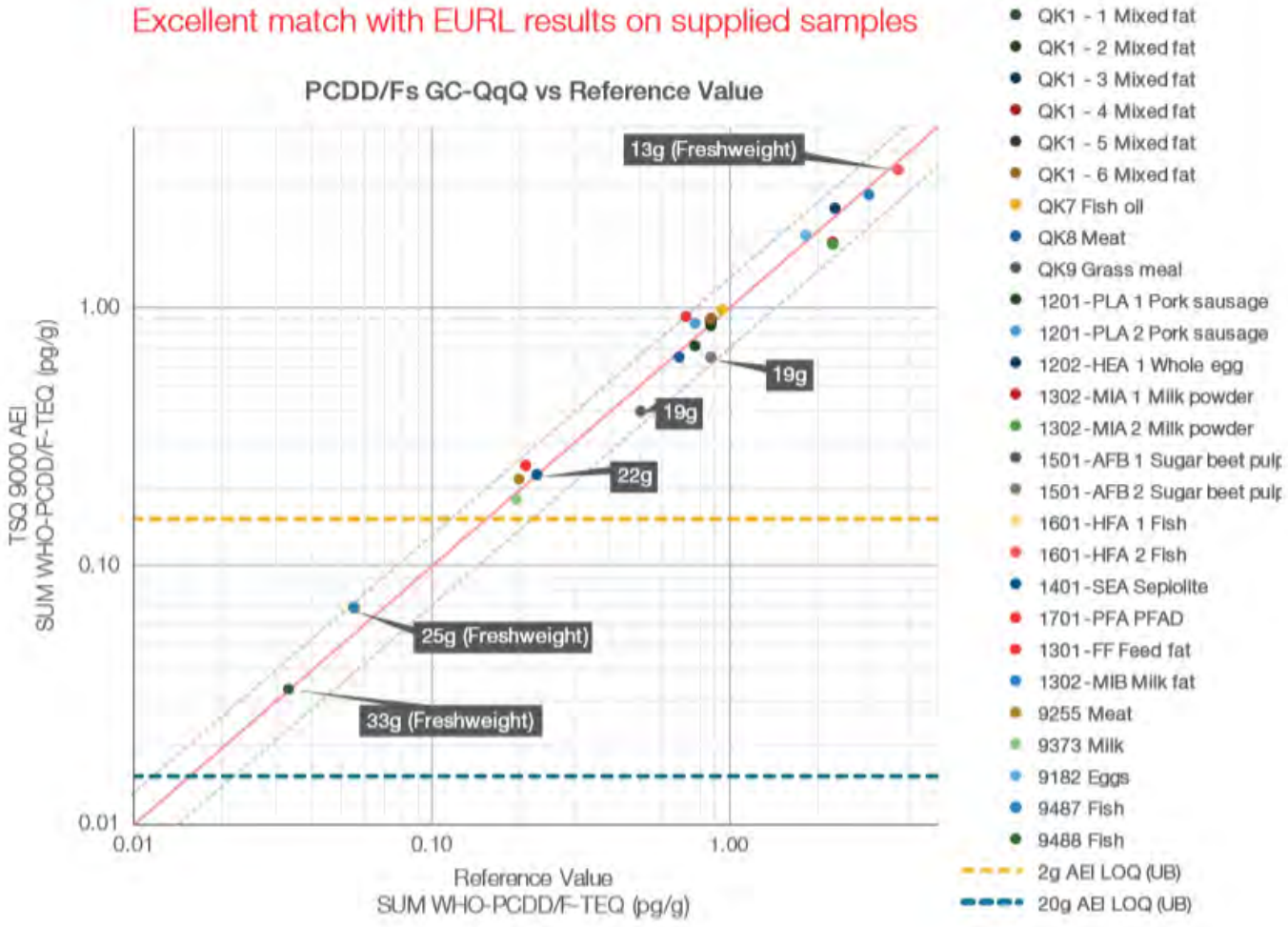
Consistent results over continuous analysis

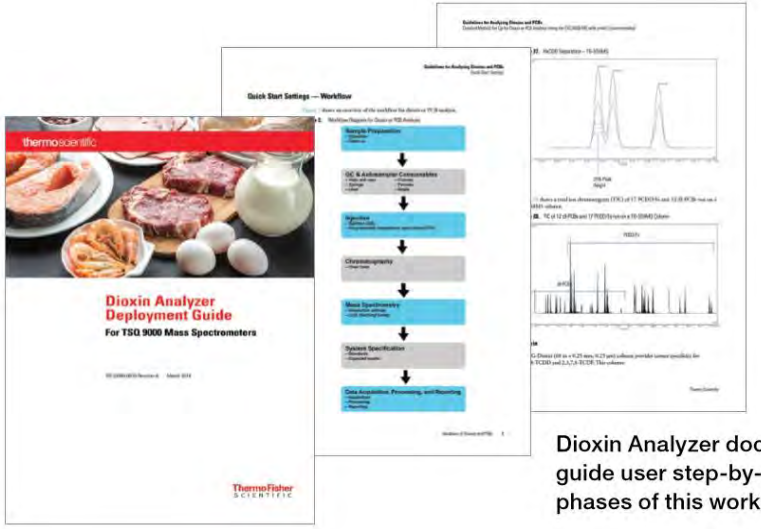




(A) Absolute peak area repeatability over two weeks of analysis, for selected PCDD/F congeners in pooled matrix sample. Relative standard deviations and amounts on-column (pg) are annotated for each selected congener. (B) LOQ Response Factor (RF) deviation (upper plot, calculated as deviation from target amount) and Ion Ratio, IR, (lower plot) for the 10 fg on-column 2,3,7,8-TCDD congener (2.5 fg/µL, 4 µL injection).

Excellent match with EURL results on supplied samples





Dioxin Analyzer documentation to guide user step-by-step though all phases of this workflow

Result and Report….

Error-free execution of routine analysis

The eWorkflow™ procedures provide a pre-loaded template that captures the unique aspects of a chromatography workflow and guides the operator through a minimal number of choices needed to create a finalized sequence with predefined files and a well-defined method structure. The Dioxin Analyzer eWorkflow includes all pre-optimized SRM transitions, isotope dilution calculation and reporting templates for an error-free execution of the analysis to meet compliance requirements.

Interactive results pane with real-time updates

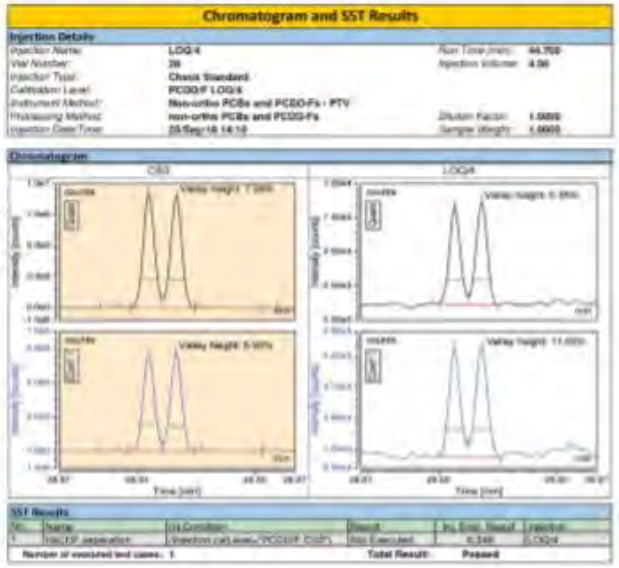
Interactive results pane showing ISTD recovery and ion ratio deviation (flagged red if outside limits) and upper, middle and lower-bound congener specific result. Sum WHO-PCDD/F-TEQ result and flag to indicate above/below maximum limit (top right). Ion ratio deviation and congener specific contribution to the WHO-PCDD/F-TEQ (bottom right).

Result and Report….

Compliance control at a glance

Compliance tools are available in the results pane and dynamically updated during the data acquisition for easy and immediate checking of results, thus saving time. This template shows for instance, internal standard (ISTD) recovery and ion ratio deviation, using a color-coded flag to visually highlight compliance/noncompliance throughout the sequence. Dynamically updated calculation results for sample Toxicity Equivalent (TEQ) are also shown and color flagged for faster action in case the results are outside of the acceptable limits.

System suitability test report



System suitability results built into the method allow for intelligent run control, ensuring samples are only analyzed if the system passes specification, saving repeat analysis time, acquisition and processing of non-compliant data

Built-in reporting tool

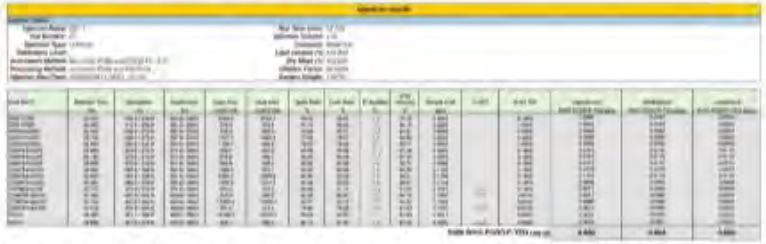
To simplify data reporting, the Dioxin Analyzer eWorkflow offers a comprehensive template that includes the required results and calculations to meet all quality and compliance requirements. This includes recovery for ^{13}C-labeled standards, ion ratio, sum parameters, and LOQ flagging amongst other features. If needed, the Report Designer enables further customization to meet all reporting and charting requirements.

Comprehensive calibration report

A

Comprehensive sample report template

B



A. Key information includes average response factor, response factor deviation and Ion ratio
B. Key results include ^{13}C-labeled standards recovery, ion ratio, sum parameters, LOQ flagging

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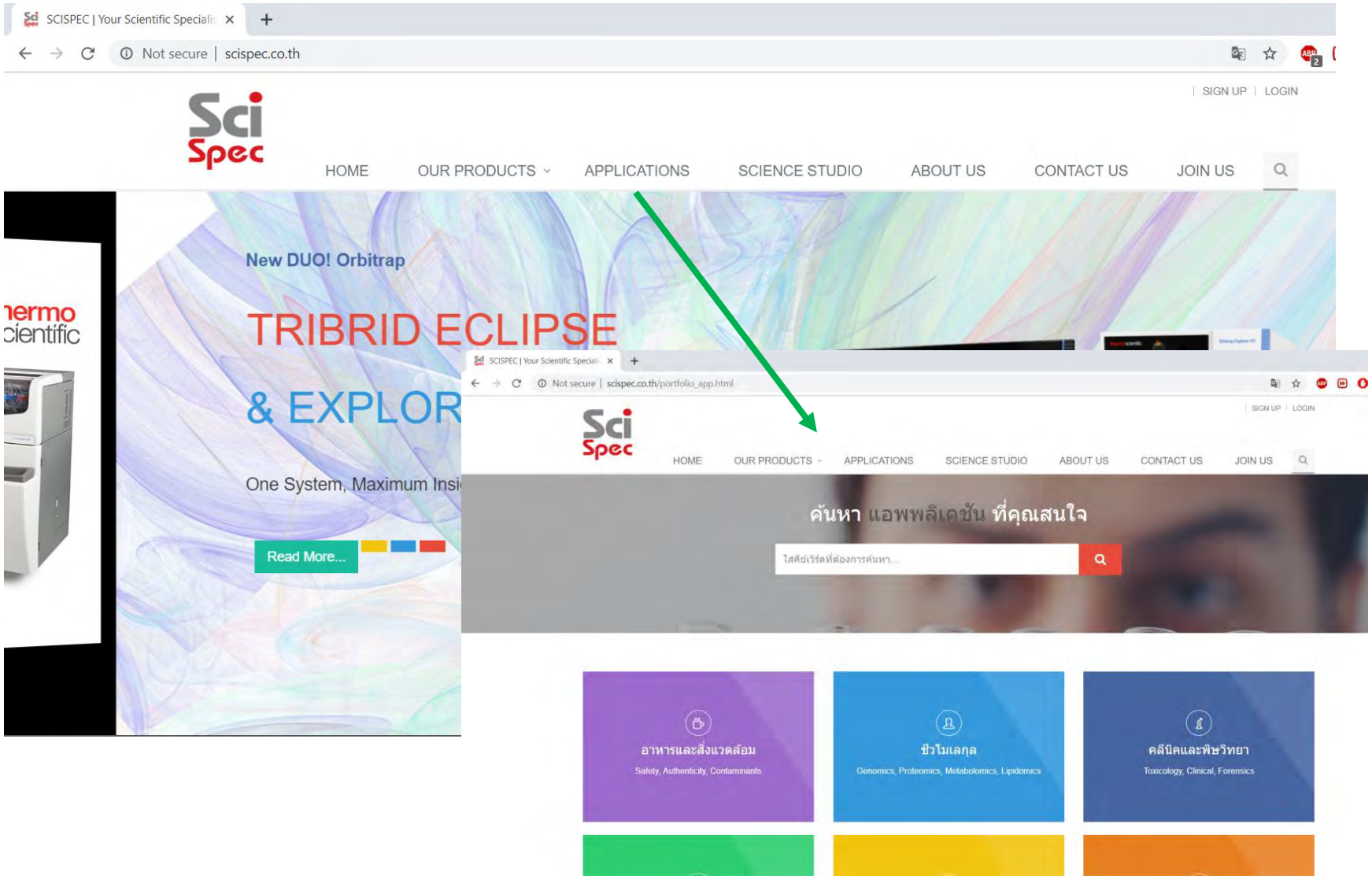
SciSpec

Thank you…..

http://www.scispec.co.th



QUESTIONS ?