Competitor comparisons

Chromatotec®

Outline

- About PerkinElmer
- Comparison between PerkinElmer, AMA, Synspec and Chromatotec®
- About the certification
- Comparison between Galvanic and Chromatotec®

Does not look like an industrial on-line instrument

PerkinElmer On-line Ozone Precursor System, comprising of a Clarus Gas Chromatograph (left) and a TurboMatrix Thermal Desorber (right).

Not easy to be installed in a factory:

- Needs big table
- Hard to move

looks like an industrial on-line instrument

Can be moved easily
Directly installed on a stable support

List of compounds that can be analyzed using PerkinElmer (found in the brochure)

Table 1. Year 2000 Volatile Ozone-Precursor Target Compounds.

Compound	CAS Registry Number	Compound	CAS Registry Number
Ethane	43202	2,3-Dimethylpentane	43291
Ethylene	43203	3-Methylhexane	43249
Propane	43204	2,2,4-Trimethylpentane	43250
Propylene	43205	n-Heptane	43232
Isobutane	43214	Methylcyclohexane	43261
n-Butane	43212	2,3,4-Trimethylpentane	43252
Acetylene	43206	Toluene	45202
t-2-Butene	43216	2-Methylheptane	43960
1-Butene	43280	3-Methylheptane	43253
c-2-Butene	43217	n-Octane	43233
Cyclopentane	43242	Ethylbenzene	45203
Isopentane	43221	m&p-Xylenes	45109
n-Pentane	43220	Styrene	45220
t-2-Pentene	43226	o-Xylene	45204
1-Pentene	43224	n-Nonane	43235
c-2-Pentene	43227	Isopropylbenzene	45210
2,2-Dimethylbutane	43244	n-Propylbenzene	45209
2,3-Dimethylbutane	43284	m-Ethyltoluene	45212
2-Methylpentane	43285	p-Ethyltoluene	45213
3-Methylpentane	43230	1,3,5-Trimethylbenzene	45207
Isoprene	43243	o-Ethyltoluene	45211
2-Methyl-1-pentene	43246	1,2,4-Trimethylbenzene	45208
n-Hexane	43231	n-Decane	43238
Methylcyclopentane	43262	1,2,3-Trimethylbenzene	45225
2,4-Dimethylpentane	43247	m-Diethylbenzene	45218
Benzene	45201	p-Diethylbenzene	45219
Cyclohexane	43248	n-Undecane	43954
2-Methylhexane	43263		

List of chemicals does not include 1,3 butadiène :

1,3 Butadiene is listed as a known carcinogen by the Agency for Toxic Substances Disease Registry and the US EPA. The American Conference of Governmental Industrial Hygienists (ACGIH) lists the chemical as a suspected carcinogen. The Natural Resource Defense Council (NRDC) lists some disease clusters that are suspected to be associated with this chemical.

1,3-Butadiene is also a suspected human teratogen. Prolonged and excessive exposure can affect many areas in the human body; blood, brain, eye, heart, kidney, lung, nose and throat have all been shown to react to the presence of excessive 1,3-Butadiene

Terpenes are also missing

On the next slides are listed the main characteristics listed in the PerkinElmer brochure

PerkinElmer On-line Ozone Precursor System, comprising of a Clarus Gas Chromatograph (left) and a TurboMatrix Thermal Desorber (right).

We compare these characteristics with those of airmOzone

A. Clarus 500 GC with • Dual FIDs with manual pneumatics • Heartcut device with manual pneumatics	Can be done by chromatotec
B. Clarus 500 GC with • Dual FIDs with PPC • Heartcut device with PPC	Can be done by chromatotec
Continuous, on-line monitoring The requirements of on-line air monitoring systems include: • Continuous unattended operation	Can be done by chromatotec
• Sampling at regular intervals with minimal idle time (1 analysis/hr, 24 results/day)	Better: we do it in 30 minutes
• Ability to trap a wide volatility range of samples	Better: more compounds
• Operation without liquid cryogen	Same for chromatotec
• Rapid transfer of analytes from the focusing device to the GC for high-resolution capillary chromatography	Same for chromatotec
• Automatic calibration	Same for chromatotec
• Sub-ppb detection limits using Flame Ionization Detector (FID)	Same for chromatotec
• Stable retention times	Same for chromatotec
• Precise and accurate quantitative performance	Same for chromatotec

PPC provides the following system benefits:	
• Less susceptibility to drift, providing consistent performance	Same for chromatotec using MFCs
• Real-time monitoring and control of all flow rates	Same for chromatotec using MFCs
• The Log file lists all pneumatic deviations	Same for chromatotec using MFCs
• Better control at low outlet split ratios	Not needed: we inject the whole sample! Better precision!
• Less baseline artifacts because of direct control of pressure entering column	No artifacts here
• All settings are in a single method for ease-of-setup	We have two sequences: loaded before– not problem for on-line instruments
• In-sequence trap-clean and trap-test functions	Same for chromatotec
PerkinElmer TRAP : -30°C	Chromatotec TRAP -10 °C

Table 2. Features of the Five New Thermal Desorbers.

Feature	TurboMatrix 100 TD	TurboMatrix 150 ATD	TurboMatrix 300 TD	TurboMatrix 350 ATD	TurboMatrix 650 ATD
Autosampler for tube analyses		●		●	●
PPC control of all flows and pressures			●	●	●
Sulfinert-coated metal transfer line	●	●	●	●	●
Air drier to prevent ice build-up on cold trap	○	○	○	○	○
Tube by-pass kit for robust long-term use	●	●	●	●	●
Trap-impedance monitoring					●
Air toxics analysis with tube dry purge					●
Remote control software for PC control	●	●	●	●	●
Fully integrated control from TotalChrom 6.3	○	○	○	○	○
Third-party software for control via telephone, internet, etc.	○	○	○	○	○

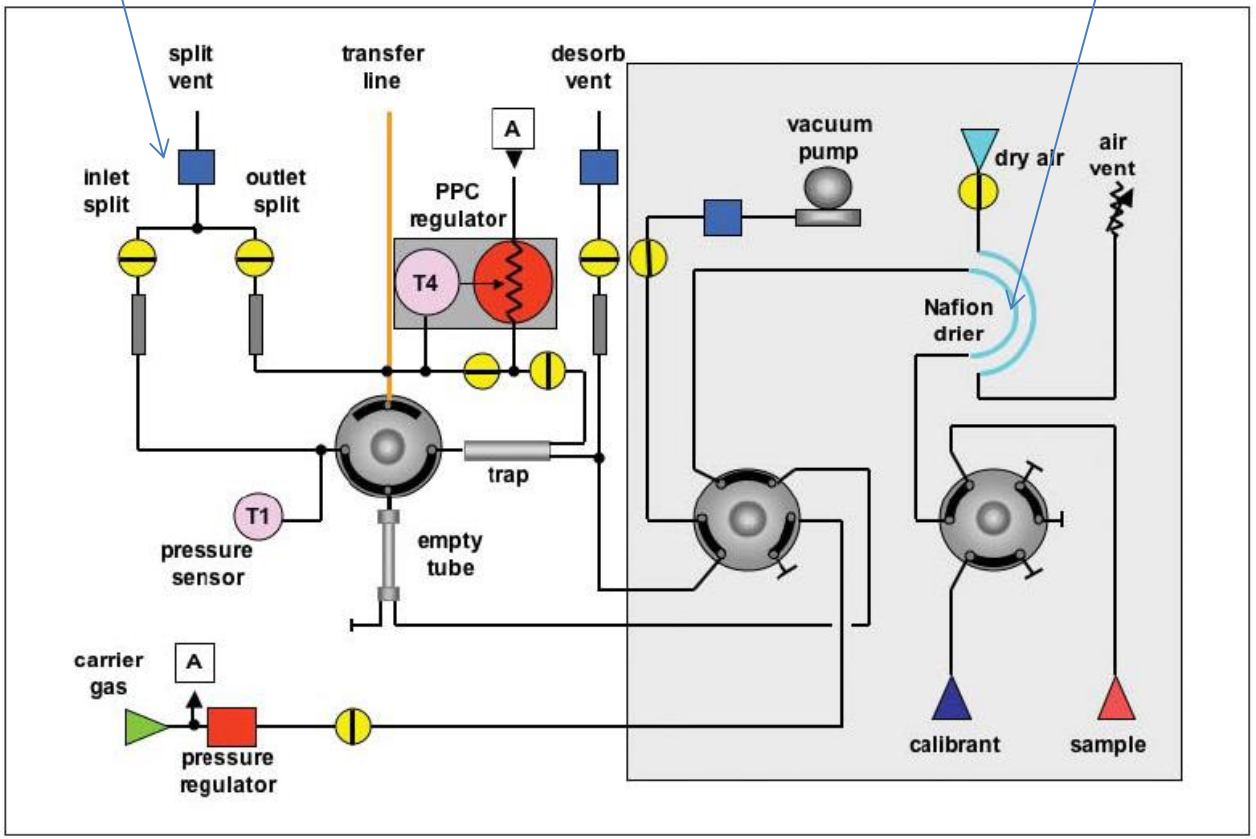
● = standard; ○ = optional

Their best instrument is required to compete with airmOzone

Sampling system

Not needed for online industrial instruments:
•increases risks of leaks

The whole sample is dried: risk of contamination (used only for C2-C6 by chromatotec)



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	PERKIN ELMER	AMA	Synspec	CHROMATOTEC
Concept and Construction	Laboratory	Rack mounted	Rack mounted	Rack mounted System is made for air monitoring more than for laboratory use
Communication	Good software	low cost software	low cost software	⊕ remote control of the instrument : - Temperature - Pressure - Thermo Desorption
certification	Experienced : more than 15 years + US EPA support : no T014	No certification and bad experience in VOC	Only old benzene certification No certification for voc in Interferences	In , more than 150 instruments to analyse Benzene, Toluene Ethylbenzene and Xylenes : TUV certificat in 1996 Certification for VOC by Mcert/NPL in process
colums	Fused silica : breakable maybe they now use other ones	Fused silica : breakable	Fused silica : breakable	**Metallic: unbreakable**
Delay to restart system	Injection in 2 columns by pressure valve. ⊖⊖ 2 days to 3 days to restart a system by a specialist			**⊕⊕ 15 to 30 minutes to restart a system.**
Validation and injection quality	No validation with permeation tube ⊖ Split injection, loose of mass trapped			**⊕⊕ Validation because we can use response factor for all compounds and calibrate with Butane and Benzene. 100% of the sample is injected**
Stability and repeatability	Injection in 2 columns by pressure valve.This create long terme unstability		PID lamp drift	**Piezo valve** with good temperature gradient: one week retention time very stable. RSD=2% on area (48 hrs) No retention time difference between standard and air (no matrix effect). RSD=0.3% on RT(48 hrs)
Flexibility of the analyser	1 trap / 1 sampling volume 1 low thermo desorption : 30% of C10 are loosed t only 1 oven		Complex system with FID+PID	2 traps / 2 sampling volumes 2 thermo desorption 2 ovens : **⊕⊕ FLEXIBILITY**
Sequence	No sequence / only 1 Method			Zero Air / Method 1 Analysis / Method 2 Calibration / Method 3

	PERKIN ELMER	AMA	Synspec	CHROMATOTEC
Cycle time Method	60 minutes	30 minutes	30 minutes	30 minutes ⊕⊕ **2 times faster** More time for maintenance Quicker maintenance
permeapure	Problem for pinenes	NO	NO	Permeapure is not used on C6/C12: we can analysed pinenes (58 japan list)
Cancerigen + PAMS	No 1.3 Butadiene; Meet the requirements of PAM's list 56 compounds	The separation of PAM's list 56compounds	The separation of PAM's list 30 compounds is poor C2H2 not analysed Limited voc list	1.3 Butadiene in airmoVOC ; Meet the requirements of PAM's list 55 compounds ⊕⊕ **every country now wants Benzene and 1.3 Butadiene because of increasing cancer risks.**
CALIBRATION	**Gas cylinder**	**Gas cylinder**	**Gas cylinder**	**Permeation tubes** **NO cylinder outside the rack system**
LINEARITY	**good**	**poor**	--	**R2 > 0.995**
Protocol	NO Protocol: PC anywhere	NO Protocol:	Protocol	Vistachrom on line software: e.g. : pilot of alarm MODBUS PC anywhere
Sampling volume	online	The sampling volume is only **manually** entered into the software !	Syringe +pump	Volume measured and calculated in continu ⊕⊕**measures the sampling volume**
Carrier Gas	Helium in cylinder High Quality/ high Cost	Helium in cylinder High Qaulity/ high Cost	Nitrogen in cylinder High Quality/ high Cost	Hydrogen as carier gas No extra cost, used also for FID
Regulation of carrier gas	No pressure gradient	Manual pressure regulator		Piezo Valve and pressure gradient Pilot by remote control
Cooling trap	-30°C	< -10°C	< -10°C	-8°C
Detector	FIDx2	FIDx2	FID + PID	FIDx2
Sensitivity	100ppt	＞200ppt	Lamp!	＜5 PPT: TUV certificat
price	expensive	low cost	low cost	Good Quality / price ratio
Peak Table	Two different peak tables for calibration and ambient air			One peak table for calibration and ambient air

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Certificate from SIRA for the EN 14662-3

sira CERTIFICATION CSA Group

MCERTS

Environment Agency

PRODUCT CONFORMITY CERTIFICATE

This is to certify that the

GC 866 FID airmoVOC (Model A21022)

manufactured by:

Chromatotec® / airmotec
15, Rue d'Artiguelongue
33240 Saint'-Antoine
France

has been assessed by Sira Certification Service
and for the conditions stated on this certificate complies with:

MCERTS Performance Standards for Continuous Ambient Air Quality Monitoring Systems, Version 8, dated June 2012;
EN 15267-1:2009, EN 15267-2:2009 & EN 14662-3:2005

Certification Ranges :

Airborne Benzene Vapour: 0 to 50 µg/m^3

Project No:	16A0385A
Certificate No:	Sira MC130231/00
Initial Certification:	26 July 2013
This Certificate Issued	26 July 2013
Renewal Date:	25 July 2018

R Cooper | Eng MInst MC

MCERTS is operated on behalf of the Environment Agency by

Sira Certification Service
12 Acorn Industrial Park, Crayford Road, Crayford
Dartford, Kent, UK DA1 4AL
Tel: +44 (0)1322 520500 Fax: +44 (0)1322 520501

Normative references:
EN ISO 14956, ENV 13005, ISO 5725-2:1994, ISO 5725-3:1994, ISO 6142, ISO 6143, ISO 6144, ISO 6145 series

Laboratory:
- It is recommended to have a laboratory ISO/CEI 17025
- NPL is ISO/CEI 17025

Online report from Synspec :
http://www.synspec.nl/pdf/certificaten/UMEGtest%20EN14662-3.pdf

Synspec uses a report where one test, required in the EN 14662-3, is missing

Also, one test has been modified to obtain a valid result

Online report from Synspec :
http://www.synspec.nl/pdf/certificaten/UMEGtest%20EN14662-3.pdf

Paragraph of the standard	Performance characteristics	Symbol	Performance criterion	Result	Paragraph of the test report
8.5.3	Lack of fit, largest residual	X_i	< ± 5 %	**GC 1545:** 0,51 % **GC 1561:** 1,09 %	6.1
8.5.5	Repeatability at zero concentration	$r_{(0,5)}$	< ± 0,3 µg/m³	**GC 1545:** 0,04 µg/m³ **GC 1561:** 0,02 µg/m³	6.3
8.5.5	Repeatability at limit value	$r_{(LV)}$	< ± 5 %	**GC 1545:** 0,23 % **GC 1561:** 0,76 %	6.3
8.5.9.1	Influence of the interference from ozone at span value	b_{O3}	< ± 5 %	**GC 1545:** 0,03 % **GC 1561:** 0,26 %	6.7.1
8.5.9.3	Influence of the interference from sum of possible interfering organic compounds at span value (Concentration of tetrachloro-methane < 1,5 µg/m³)**	b_{org}	< ± 5 %	**GC 1545:** 2,5 % **GC 1561:** 3,8 %	6.7.3
8.5.9.2	Influence of the interference from relative humidity at limit value	b_{rh}	< ± 4 %	**GC 1545:** 0,13 % **GC 1561:** 0,42 %	6.7.2
8.5.7	Sensitivity coefficient for the influence of surrounding temperature at span value	b_{Ts}	< ± 0,2 %/K	**GC 1545:** 0,14 %/K **GC 1561:** 0,08 %/K	6.5
8.5.8	Sensitivity coefficient for the influence of voltage at span value	b_V	< ± 0,2 %/V	**GC 1545:** < 0,01 %/V **GC 1561:** < 0,01 %/V	6.6
8.5.4	Short term drift at span value (24 h)	d_{24h}	< ± 5 %	**GC 1545:** 0,65 % **GC 1561:** 1,04 %	6.2
8.5.10	Carry-over (memory effect)	Y	< 0,5µg/m³*	**GC 1545:** 0,14 µg/m³ **GC 1561:** 0,10 µg/m³	6.8

*: 10 % of the limit value for the first analysis after the response time

**: Both gaschromatographs have an interference > 5 % to tetrachloromethane at interferent concentrations > 1,5 µg/m³ (see paragraph 6.7.3)

"Sensitivity coefficient for the influence of surrounding pressure at span value" is missing from the results!

$$b_p = \frac{|(C_{Ts,max} - C_{Ts,min})|}{|\Delta P|} < \pm 1\%/kPa$$

EN 14662-3: 2005

Online report from Synspec :
http://www.synspec.nl/pdf/certificaten/UMEGtest%20EN14662-3.pdf

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8.5.8	Sensitivity coefficient for the influence of voltage at span value	b_V	< ± 0,2 %/V	GC 1545: < 0,01 %/V GC 1561: < 0,01 %/V	6.6
8.5.4	Short term drift at span value (24 h)	d_{24h}	< ± 5 %	GC 1545: 0,65 % GC 1561: 1,04 %	6.2
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*: 10 % of the limit value for the first analysis after the response time

**: Both gaschromatographs have an interference > 5 % to tetrachloromethane at interferent concentrations > 1,5 µg/m³ (see paragraph 6.7.3)

Due to VOC interferences, Synspec PID GC 955 **does not meet criteria of norm EN-14662-3.**

For the interference, tetrachloromethane has been removed!

Written on page 38:

6.7.3.3 Assessment
The requirement of the standard is not met without qualification.
Qualification:
Under the influence of tetrachlormethane both gas chromatographs show a negative result for benzene, dependent on the concentration of the interferent.
At a concentration of tetrachloromethane of more than 1,5 µg/m³ both instruments show a distinct interfer-ence on the present test conditions.

Certification" process from NPL and a critique of the approvals of other analyzers

NPL

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12th October 2011

AIRMOTEC AG SA
15 rue d'Artiguelongue
33240 SAINT-ANTOINE
France

Dear Mr Amiet,

Re : Type testing of Chromatotec/airmotec : GC 866 by NPL (ISO 17025 for VOC)

2 x FID : airmoBTX (Model A21022, serial number 20730509 & 20190309),
2 x PID :airTOXIC (Model A73022, serial number 20430309 & 20720509),
to **EN 14662-3 : 2005_ambient air quality- standard method for the measurement of benzene concentration**.

I can report that the eleven required laboratory performance characteristics have been determined. The Tests were carried out in compliance with the requirements of European Standard EN 14662-3: 2005. Subject to review by the UK MCERTS Certification Committee (SIRA), the performance criteria have been met for:

Eleven required laboratory performance and not 10

Paragraph of the standard	Performance characteristics	Symbol	Performance criterion
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8.5.4	Short term drift at span value (24 h)	d_{24h}	< ± 5 %
8.5.10	Carry-over (memory effect)	Y	< 0,5µg/m³*

Sensitivity coefficient for the influence of surrounding pressure at span value — B_p — < ± 1 %/IPa

NPL

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26th November 2012

AIRMOTEC AG SA
15 rue d'Artiguelongue
33240 SAINT-ANTOINE
France

Dear Mr Amiet,

Re : Type testing of Chromatotec/airmotec : GC 866 by NPL (ISO 17025 for VOC)

2 x FID : airmoBTX (Model A21022, serial number 20730509 & 20190309),
2 x PID :airTOXIC (Model A73022, serial number 20430309 & 20720509),
to **EN 14662-3 : 2005_ambient air quality-standard method for the measurement of benzene concentration**.

Subject to review by the UK MCERTS Certification Committee (SIRA), I can report that both the laboratory and field tests have now been completed in accordance with the requirements of European Standard EN 14662-3: 2005.

Yours sincerely,

Heather Powell

Heather Powell
Head of Environmental Measurements Group

Letter from the NPL for the on-site tests

Performance characteristics	Symbol	Performance criterion
Reproducibility standard deviation	s_{Rf}	$< \pm 0{,}25\ \mu g/m^3$
Long term drift at span value (14 d)	d_{14d}	$< \pm 10\ \%$
Maintenance interval		> 14 d
Availability	A_a	$> 90\ \%$

For each experiment, we have the details of all equations used to calculate the different values.
Can be asked by costumers

PerkinElmer has no certification

PerkinElmer On-line Ozone Precursor System, comprising of a Clarus Gas Chromatograph (left) and a TurboMatrix Thermal Desorber (right).

Our instruments have fulfilled all the requirements of the EN-14662-3

This is a proof of performance!

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Technical specification	Galvanic	Chromatotec®
Name of the analyzer	902 H2S analyzer*	H2S / TOS / TS MEDOR
Detection principle	Lead acetate tape	Wet cell
Analysis concentration range	Up to 50 ppm in standard	Up to 100ppm in standard 3-4 minutes
Low Detection Limit	Few ppb	Few ppb
H2S analysis	Yes	Yes
Total sulfur measurement	Yes, with a converter using H2 at 900°C (Problem of conversion efficiency, precision and safety!!!) high consumption of consumable	Yes no converter needed
Cycle time	3-4 minutes	2 minutes for 0-4ppm and 3-4 minutes for 0-100ppm
Multiplexer	Up to 8 streams	Up to 16 streams
Lifetime without maintenance	Typical tape life given 3 minutes cycle time is 5 weeks	Need to add few mL of water to the detector every 12 weeks
Calibration	External cylinder	Internal calibration oven
4 – 20 mA output	Yes	Yes
Modbus	As option	As option
Support gases	He + H2 + air (cylinder are required)	Air (with generator)
Service costs	High, due to support gases and vacuum	Low due to simplicity of the system
Data availability	Low data capture	High data capture > 95%

* information coming from Galvanic website

Thank you for your attention !