Chromatography

Determination of organic contaminants in water by modern GCMS:

- Standard vs fast
- EI and NCI
- Two columns – one MS

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Shimadzu Deutschland GmbH

SHIMADZU
Solutions for Science
since 1875

Modern GCMS

- Sensitivity
- Rapid answers
- Ease of use
- Flexibility
- Includes sample prep

- GCMS-QP2010

Flexibility

1.) Different sample introduction systems

- PTV/SPL combinations

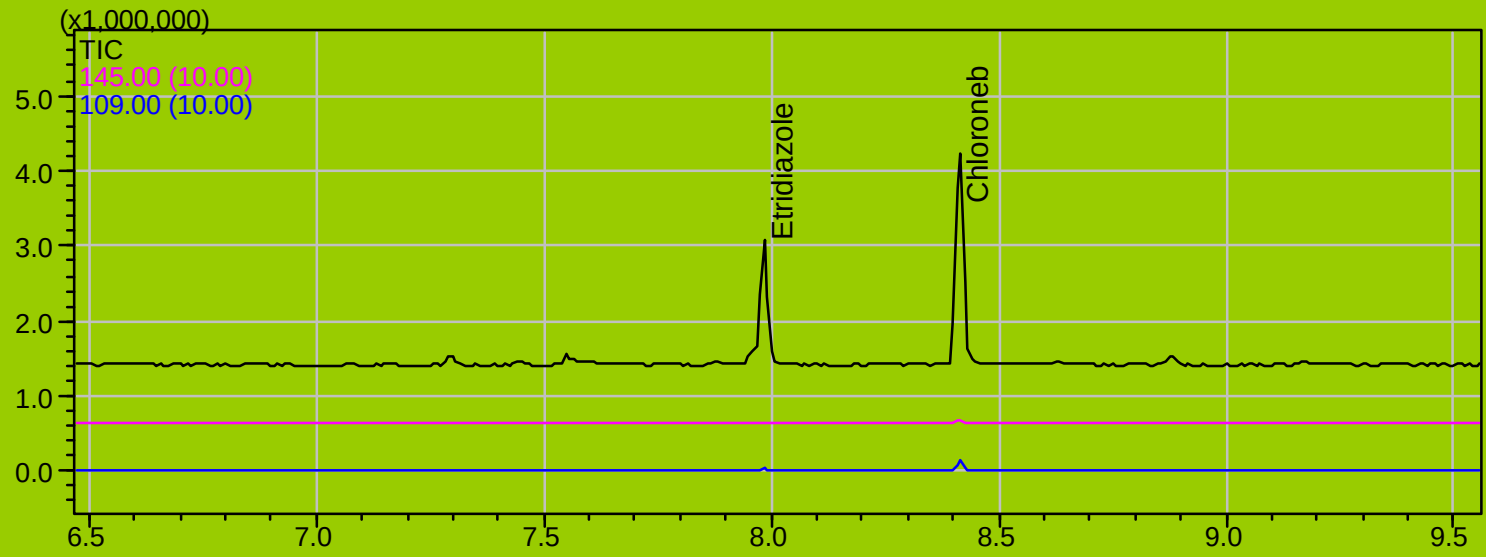
- Pyrolysis/SPL

2) Different Columns for screening many different analytes

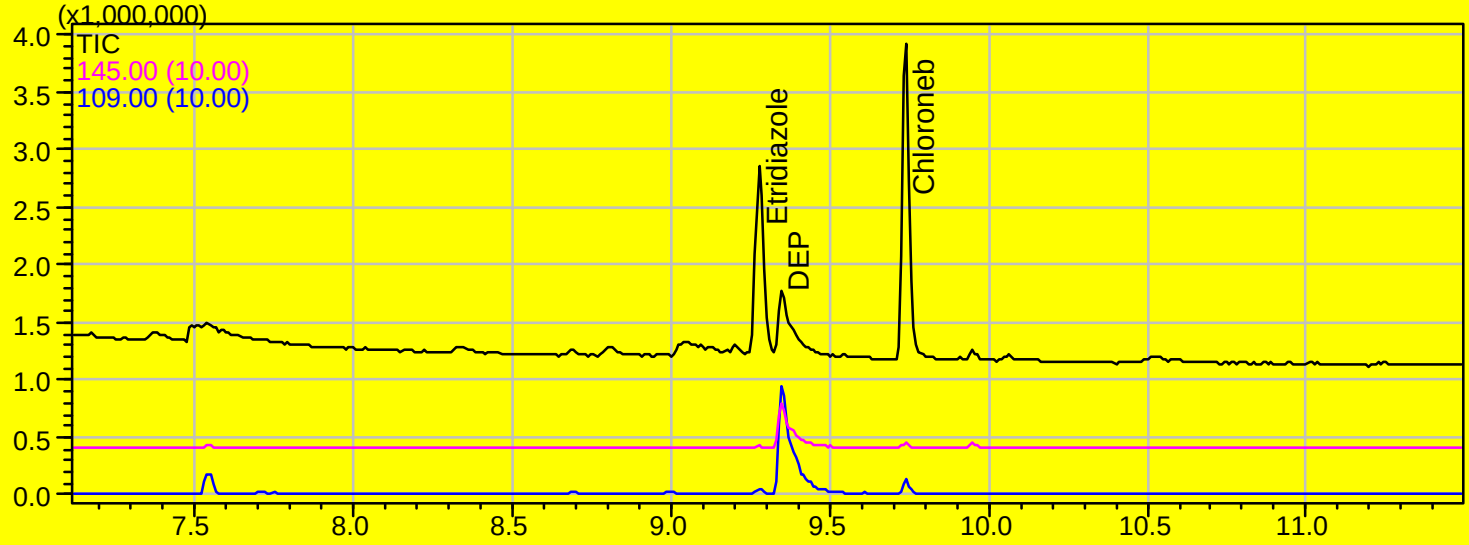
Two column – one MS setup

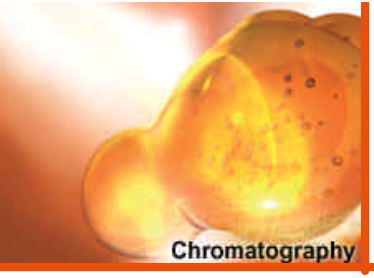
Dual Column - Pesticides

Rtx-5MS
Hot SPLITLESS



Rtx-5MS
PTV





Analytical Conditions

Rtx-5MS
SPLITLESS

? GCMS QP2010

Column	:	Rtx-5MS [30m × 0.25mm I.D. df=0.25um]
Injection Mode	:	Splitless
Injection Temp.	:	250 ?
Column Oven Temp.	:	35? (1min)? (20? /min)? 140? ? (10? /min)? 280? (3min)
Carrier Gas	:	He
Flow Control Mode	:	Linear Velocity (48.6 cm/sec)
Ion Source Temp.	:	200?
Interface Temp.	:	250?
SCAN		
Scan Range	:	m/z 70~ 360
Interval	:	0.5sec

Rtx-5MS
PTV

? GCMS QP2010

Column	:	Rtx-5MS [30m × 0.25mm I.D. df=0.25um]
Injection Mode	:	PTV
Injection Temp.	:	30? (0.5min)? (100? /min)? 280? (17min)
Column Oven Temp.	:	35? (1min)? (20? /min)? 140? ? (10? /min)? 280? (3min)
Carrier Gas	:	He
Flow Control Mode	:	Linear Velocity (48.6 cm/sec)
Ion Source Temp.	:	200?
Interface Temp.	:	250?
SCAN		
Scan Range	:	m/z75~ 360
Interval	:	0.5sec

Flexibility

Dual column setup:

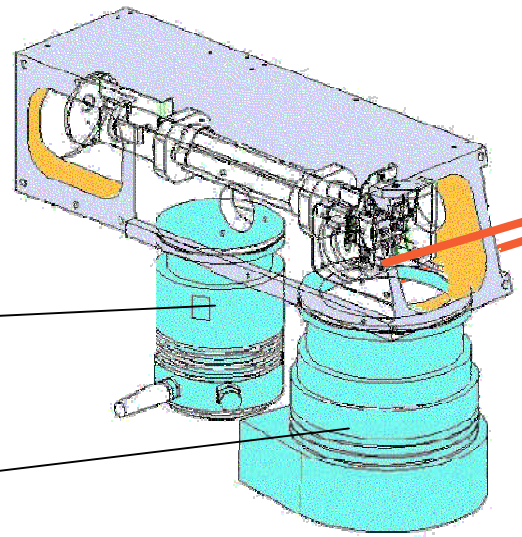
- **2 columns in 1 MS**

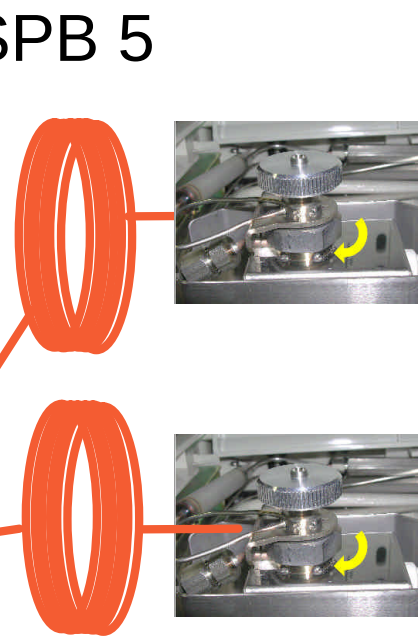
- saves effort for remounting column

- saves costs for a second MS

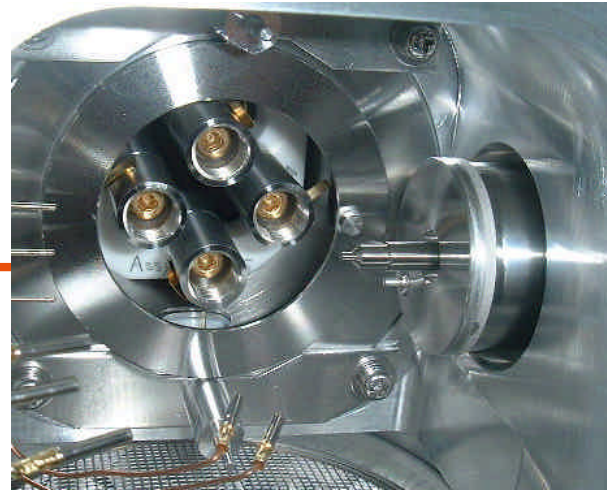
AOC-20 Dual Tower

AOC-5000

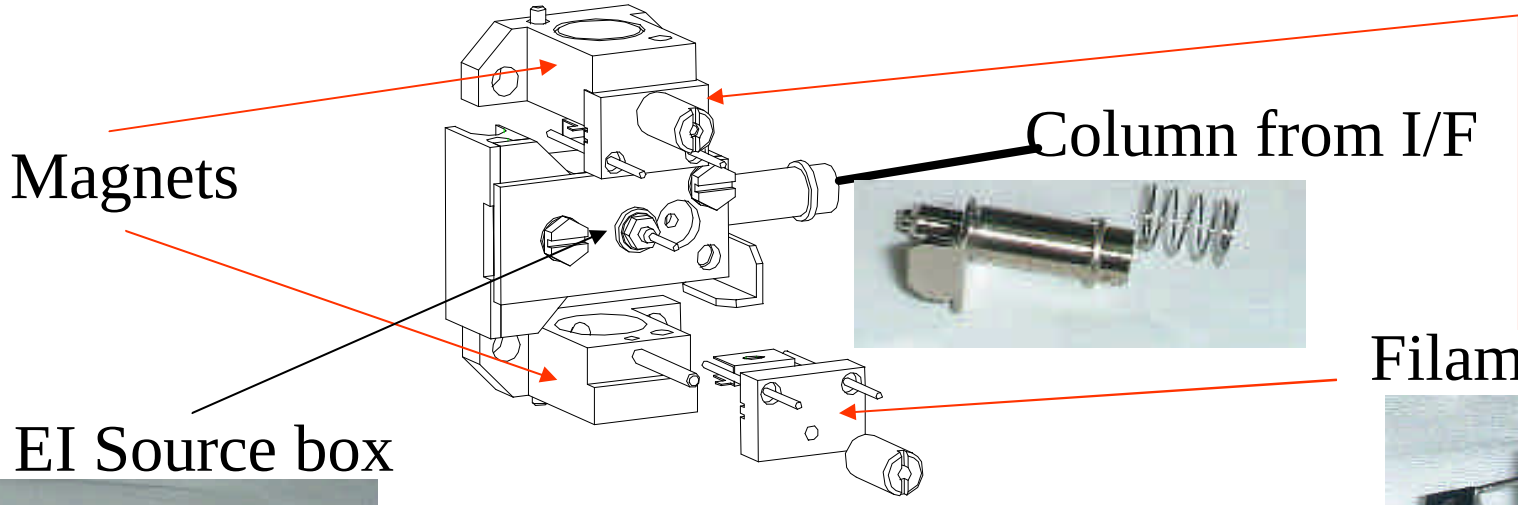




GCMS QP-2010

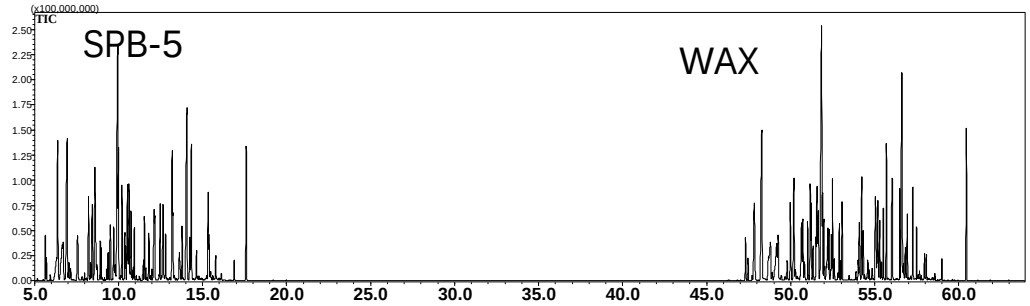


New Ion Source



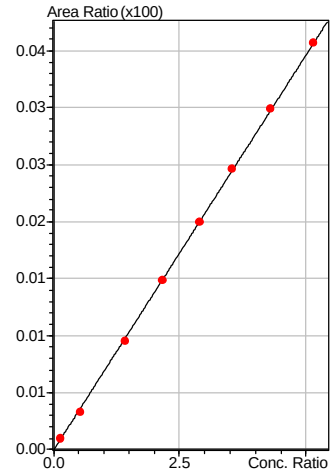
Dual Columns – Flexibility

- Allergens:
- Method based on SCAN instead of SIM



- Full Scan Information and confirmation via second column.
- H. Leijs et al: J. Agric. Food Chem. 2005,53,6487

ID	Name	m/z
1	2,3-DICHLOROTOLUENE (Cp Restek rtx-5MS, low)	125.00
2	2,3-DICHLOROTOLUENE (Cp Sil 24 CB, low)	125.00
3	BENZYL ALCOHOL (Cp Restek rtx-5MS)	108.00
4	BENZYL ALCOHOL (Cp Sil 24 CB)	108.00
5	LIMONENE (Cp Restek rtx-5MS)	68.00
6	LIMONENE (Cp Sil 24 CB)	68.00
7	LINALOOL (Cp Restek rtx-5MS)	71.00
8	LINALOOL (Cp Sil 24 CB)	71.00
9	METHYL HEPTIN CARBONATE (Cp Restek rtx-5MS)	123.00
10	METHYL HEPTIN CARBONATE (Cp Sil 24 CB)	123.00
11	CITRONELLOL (Cp Restek rtx-5MS)	81.00
12	CITRONELLOL (Cp Sil 24 CB)	81.00
13	NERAL (Cp Restek rtx-5MS)	69.00
14	NERAL 84 (Cp Restek rtx-5MS)	84.00
15	NERAL (Cp Sil 24 CB)	69.00
16	NERAL 84 (Cp Sil 24 CB)	84.00
17	CINNAMALDEHYDE (Cp Restek rtx-5MS)	131.00
18	CINNAMALDEHYDE (Cp Sil 24 CB)	131.00
19	GERANIOL (Cp Restek rtx-5MS)	93.00
20	GERANIOL (Cp Sil 24 CB)	93.00
21	GERANIAL (Cp Restek rtx-5MS)	69.00
22	GERANIAL 84 (Cp Restek rtx-5MS)	84.00
23	GERANIAL (Cp Sil 24 CB)	69.00
24	GERANIAL 84 (Cp Sil 24 CB)	84.00
25	ANISIC ALCOHOL (Cp Restek rtx-5MS)	138.00
26	ANISIC ALCOHOL (Cp Sil 24 CB)	138.00
27	HYDROXY CITRONELLAL (Cp Restek rtx-5MS)	59.00
28	HYDROXY CITRONELLAL (Cp Sil 24 CB)	59.00
29	CINNAMYL ALCOHOL (Cp Restek rtx-5MS)	134.00
30	CINNAMYL ALCOHOL (Cp Sil 24 CB)	134.00
31	EUGENOL (Cp Restek rtx-5MS)	164.00



Matrix Water

GCMS analysis according to European Drinking Water Regulations

- volatile hydrocarbons (VOC´s)
- polycyclic aromatic hydrocarbons (PAH´s)
- benzene, toluene und xylene (BTX)
- pesticides and herbicides

Dual Column-Drinking Water

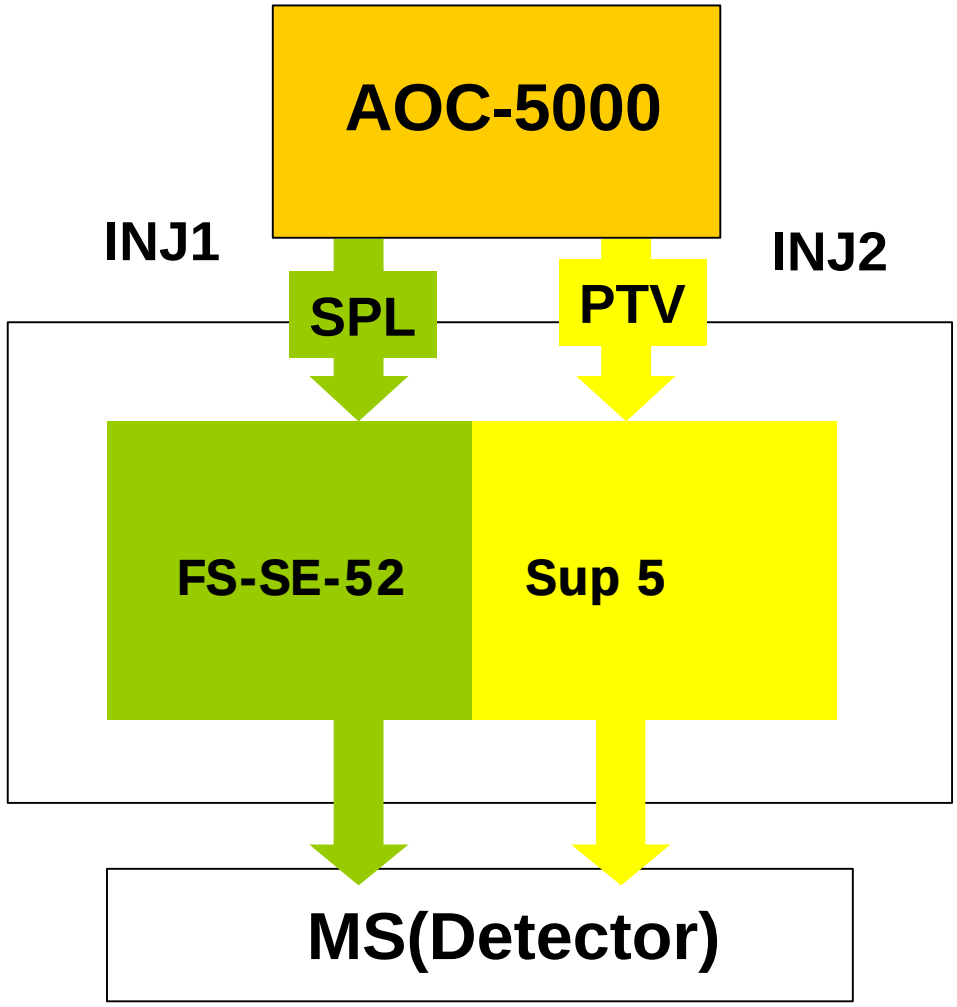
SPL: FS-SE-54

(50m × 0.32mm I.D. df=0.5um)
Analysis of VOCs

HS&

HS-SPME: Carboxen phase

PTV: Supreme 5
(30m × 0.25mm I.D. df=0.25um)
For analysis of Pesticides,PCBs...



Volatile Hydrocarbons (VOC´s) - HS

1,2-Dichlorethane:

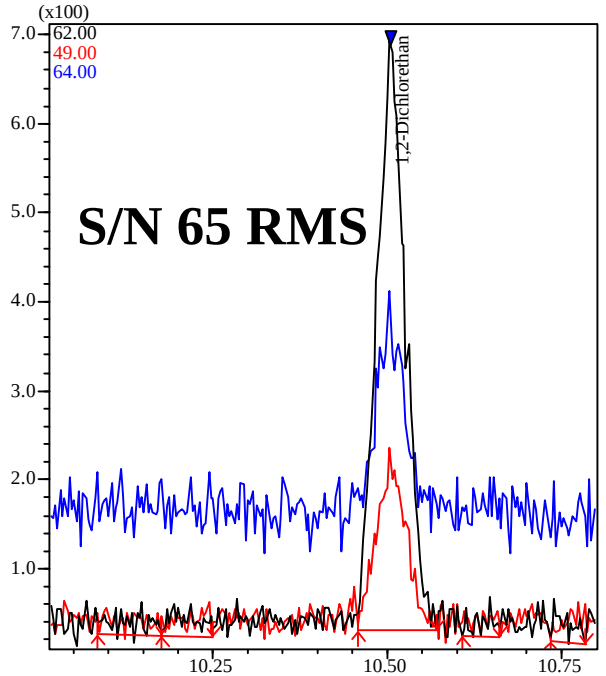
Concentration: 1 µg/l

Limit for Drinking water: 3 µg/l

Split 10:1

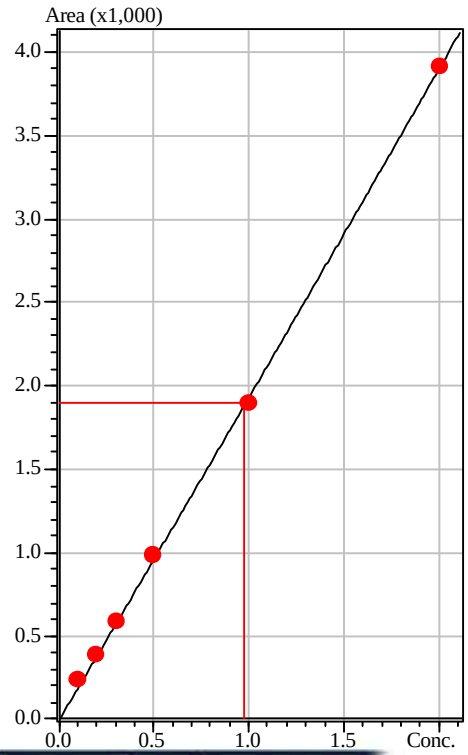
Scan 48-100, IV=0.4s

Det Gain 1 KV



HS:

80 °C, 60 min



Calibration range: 0.1 µg/l - 10 µg/l

Correlation factor: 0.9997

Benzene, Toluene and Xylene

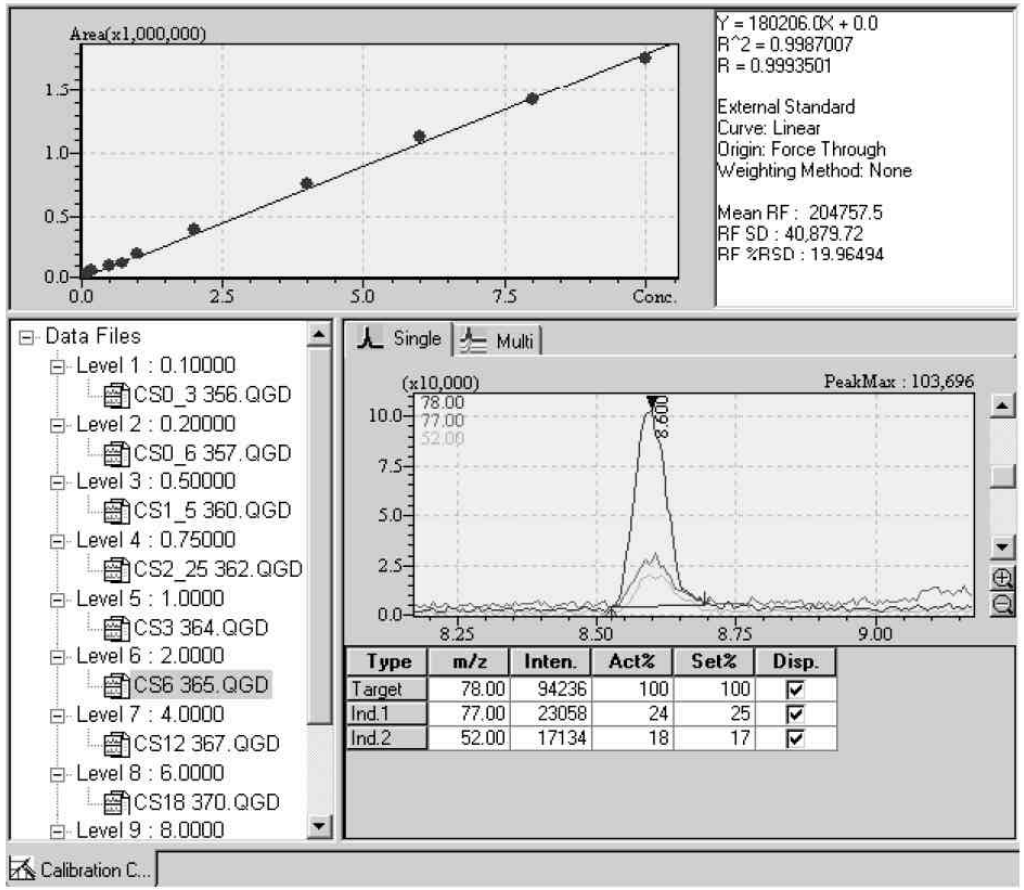
Benzene:

10 point calibration

0,1 – 10 µg/l

Drinking water limit

1 µg/l

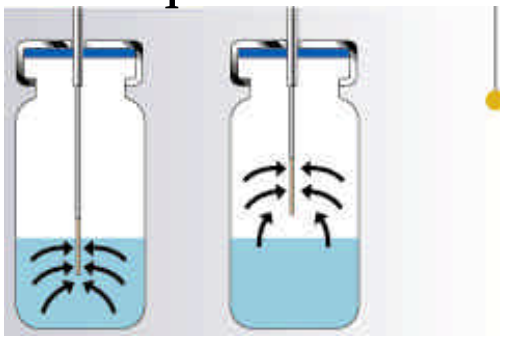


Standard 2 µg/ml

AOC 5000

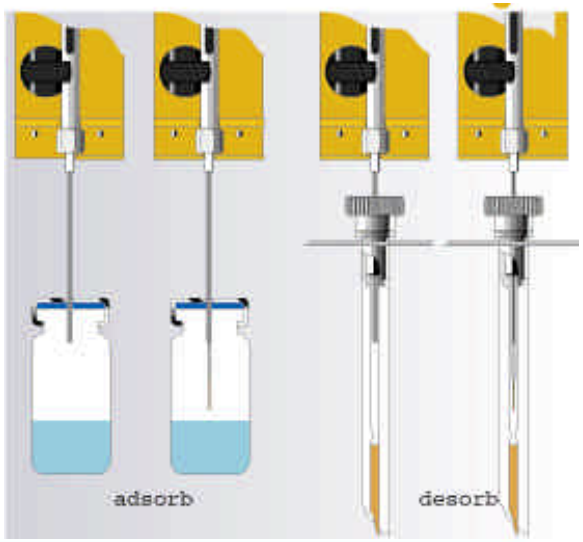
- SPME:

Variable Needle Penetration Depths
for Adsorption in Liquid or Head Space

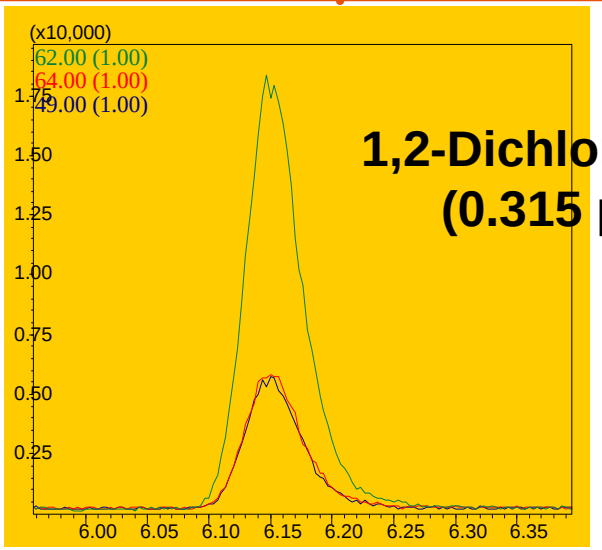


Adsorption
Vial in Agitator

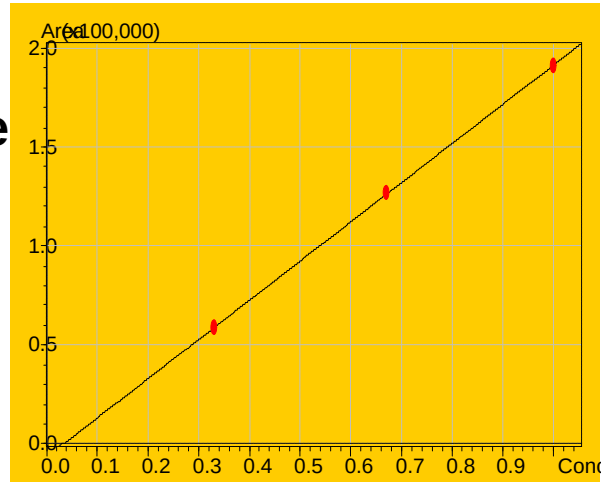
Desorption
in Injector



VOCs-HS/SPME (Carboxen)



1,2-Dichlorethane (0.315 µg/l)



SPME Calibration:

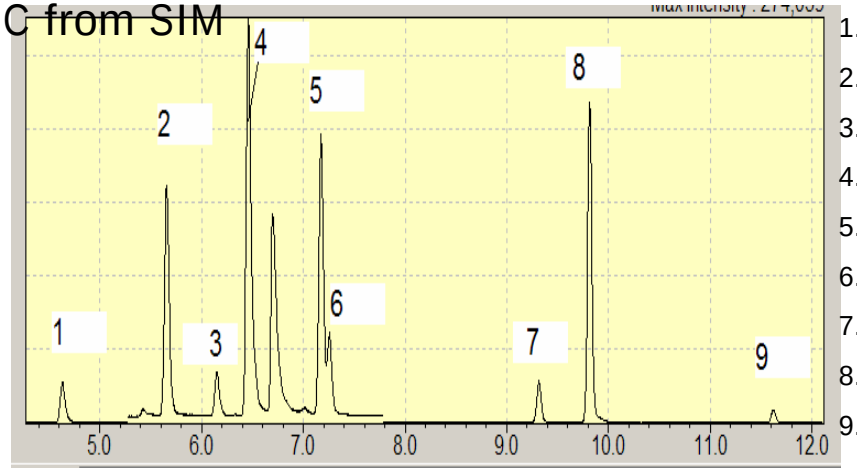
Ads.:15 min, 50°C

Des.: 0.5 min, 280 °C

Split 5:1

MS: SIM

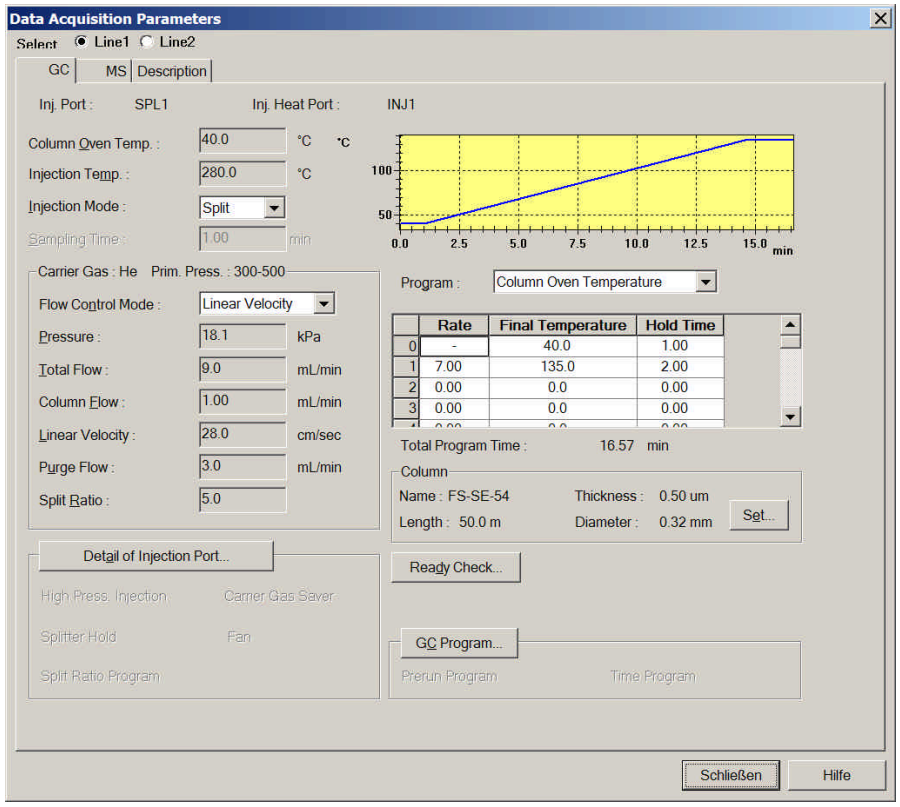
TIC from SIM

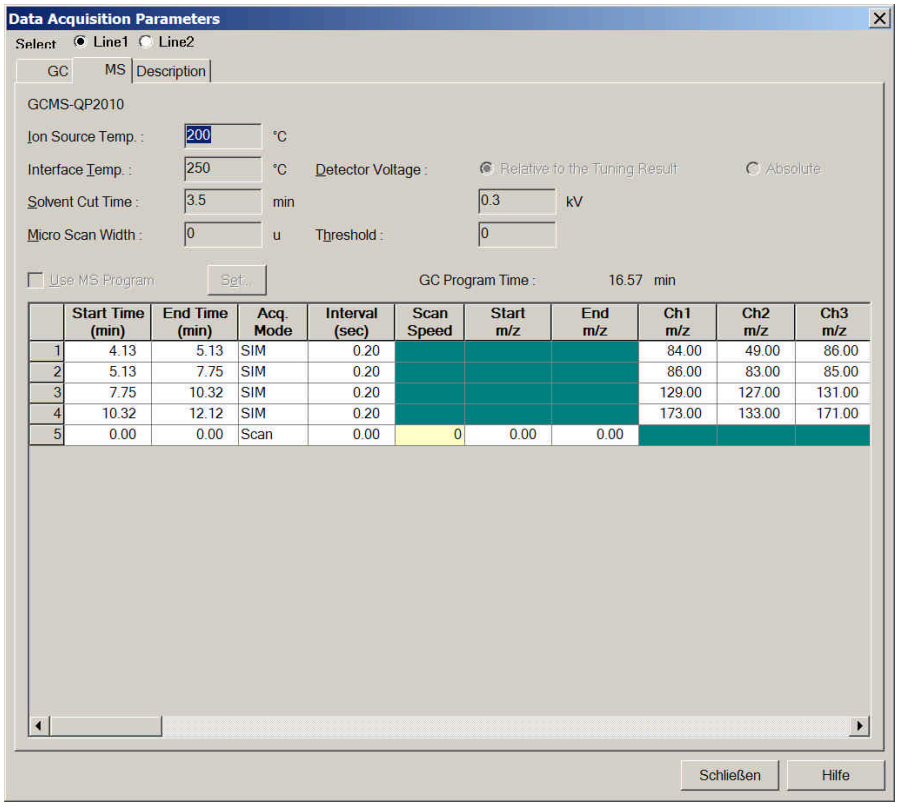


	conc ug/L	RT		QM
1. Dichlormethan	0.31725	4.635	Target	84.00
2. Trichlormethan	0.31181	5.659	Target	83.00
3. 1,1,1-Trichlorethan	0.31482	6.170	Target	97.00
4. Tetrachlorkohlenstoff	0.31942	6.502	Target	117.00
5. Trichlorethen	0.32500	7.176	Target	130.00
6. Monobromdichlormethan	0.31626	7.259	Target	83.00
7. Dibromchlormethan	0.31184	9.319	Target	129.00
8. Tetrachlorethen	0.33027	9.819	Target	166.00
9. Tribrommethan	0.31332	11.627	Target	173.00

Chromatography

VOCs-HS/SPME (Carboxen)





SHIMADZU Solutions for Science

Line 2: PCBs

- 100 ng/L

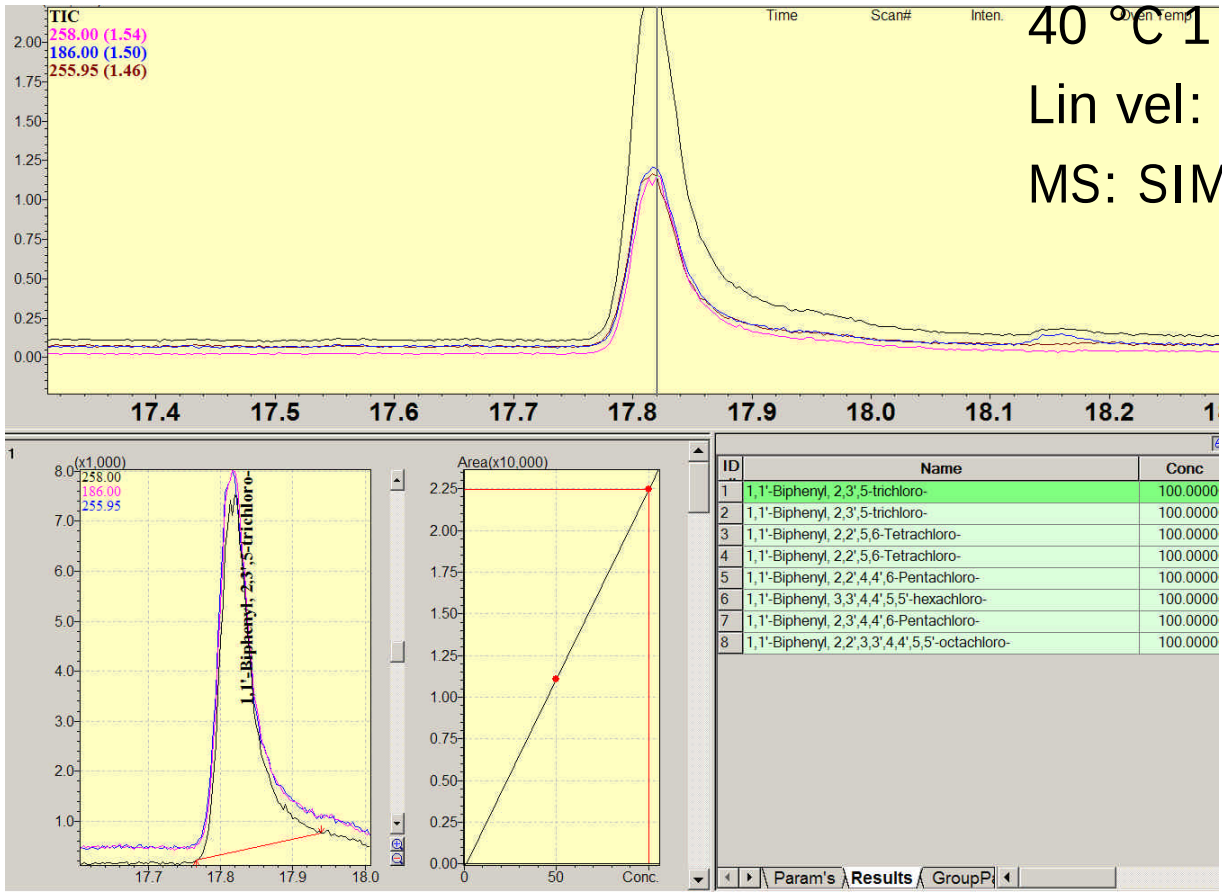
PTV Injection split 50:1

FS 5 30 m, 0.25 mm, 0.25 µm

40 °C 1 min, 10 °C/min to 280 °C

Lin vel: 40 cm/s

MS: SIM



ID	Name	Conc
1	1,1'-Biphenyl, 2,3',5-trichloro-	100.0000
2	1,1'-Biphenyl, 2,3',5-trichloro-	100.0000
3	1,1'-Biphenyl, 2,2',5,6-Tetrachloro-	100.0000
4	1,1'-Biphenyl, 2,2',5,6-Tetrachloro-	100.0000
5	1,1'-Biphenyl, 2,2',4,4',6-Pentachloro-	100.0000
6	1,1'-Biphenyl, 3,3',4,4',5,5'-hexachloro-	100.0000
7	1,1'-Biphenyl, 2,3',4,4',6-Pentachloro-	100.0000
8	1,1'-Biphenyl, 2,2',3,3',4,4',5,5'-octachloro-	100.0000

Triazine Pesticides

Procedure:

Determination of selected Nitrogen- and Phosphorous compounds, gas chromatographic procedure (DIN EN ISO 10695)

- solid phase extraction (Laborintern: HR-P (3ml/200mg) MN)
- Internal Standards used

Limit according to drinking water regulation, pesticides:

- sum concentration < 500 ng/l
- single components < 100 ng/l

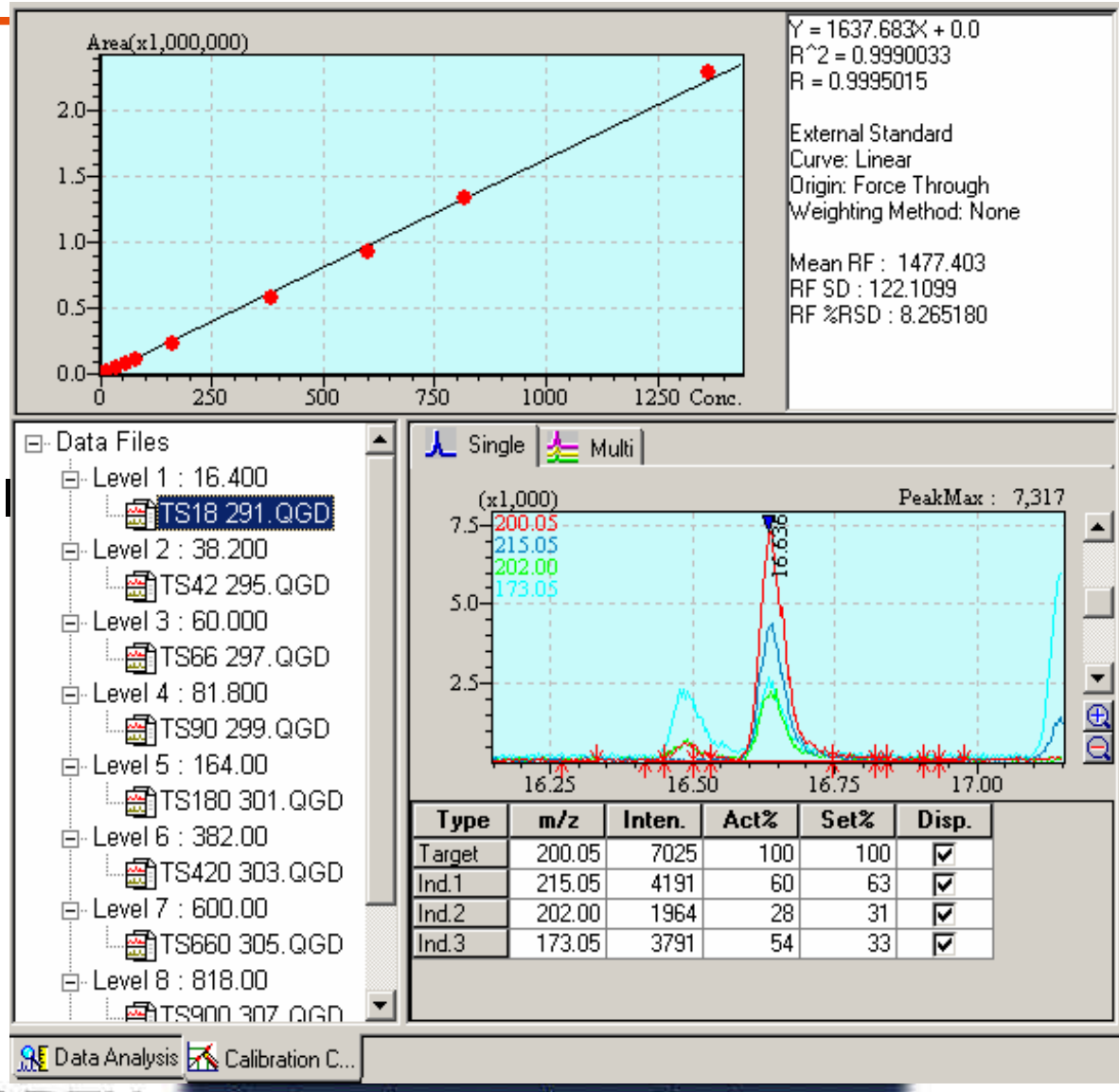
Triazine Pesticides

Atrazine

10 level calibration curve:

- calibration range: 15-1500 ng/l
- limit: 100 ng/l

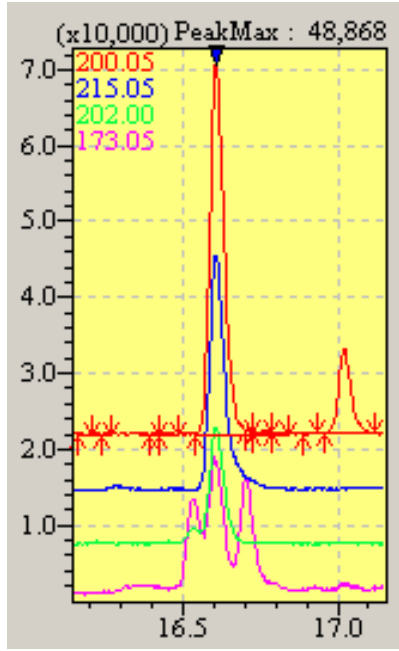
concentration determined: 16.4 ng/l



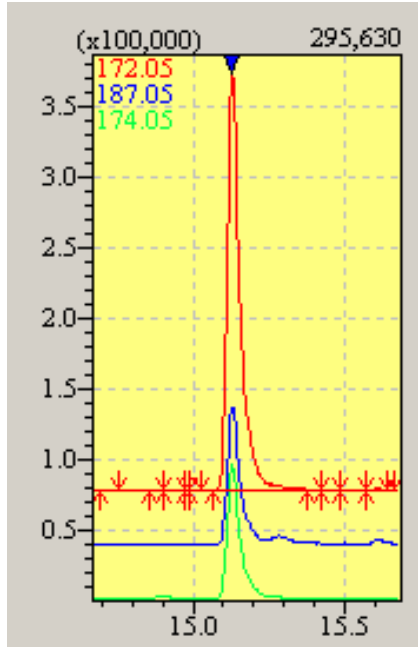
Reliability

Real sample (3 times repetitive measurement)

	Real sample (3 repetitions)		
Triazine	**MW (µg/l)**	**Std.dev. (µg/l)**	**Std.dev. (%)**
Atrazine	**0,121**	**0,002**	**1,7**
	MW (µg/l)	**Std.dev.. (µg/l)**	**Std.dev. (%)**
Atrazine-desethyl	**0,292**	**0,013**	**4,4**



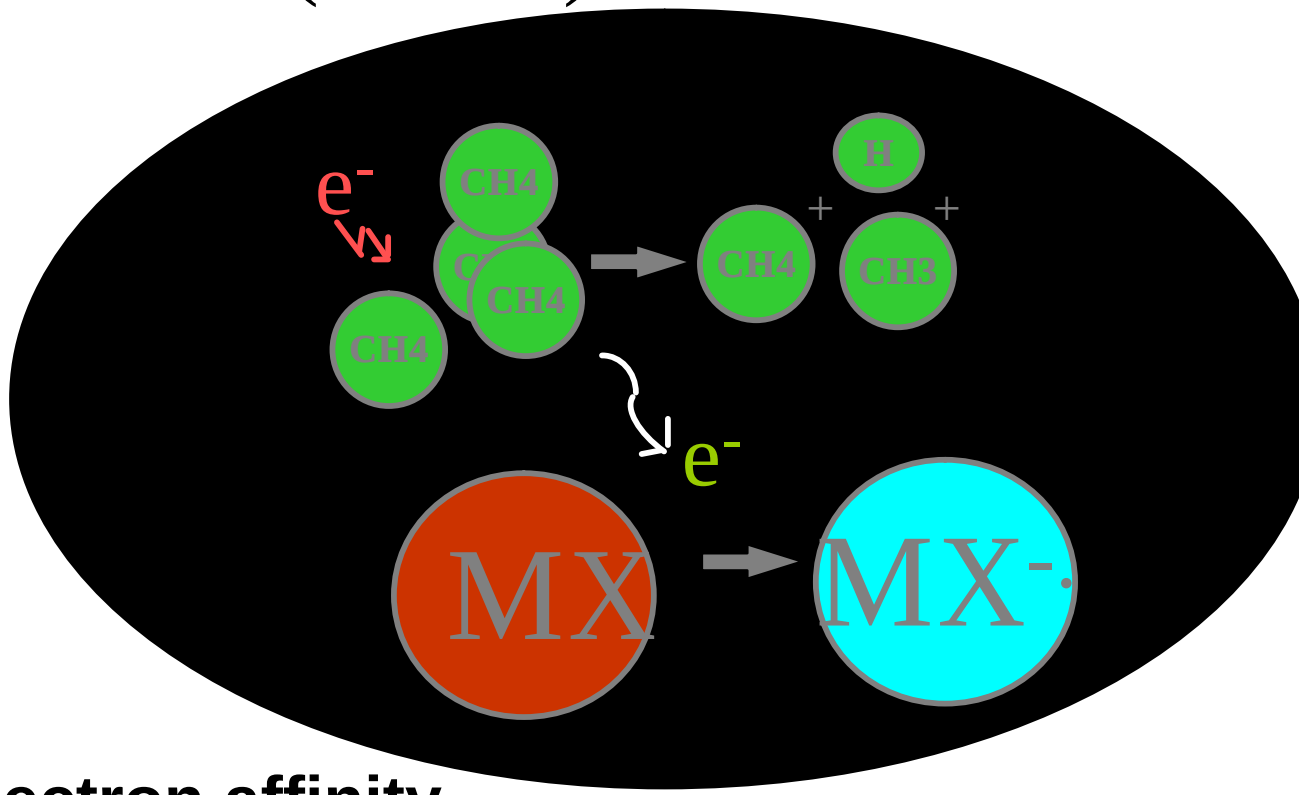
Atrazine peak in real sample



Atrazine-desethyl peak in real sample

Negative chemical Ionization NCI

- $MX + e^- (\sim 0\ eV) \rightarrow MX^{-\cdot}$

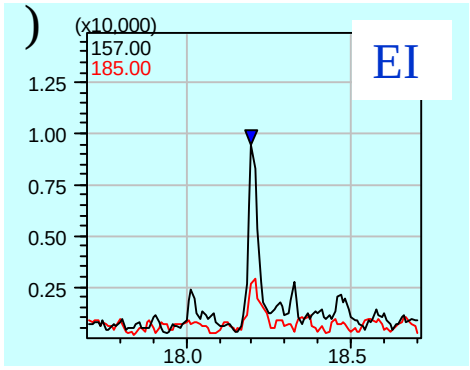


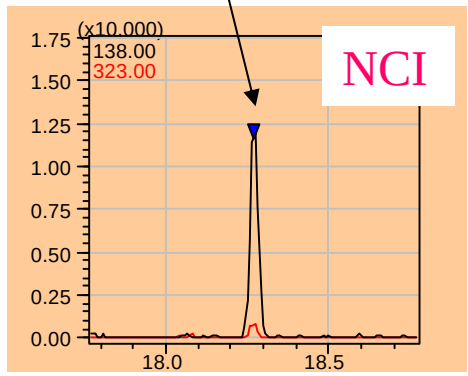
X: High electron affinity part

Comparison of Sensitivity NCI/EI

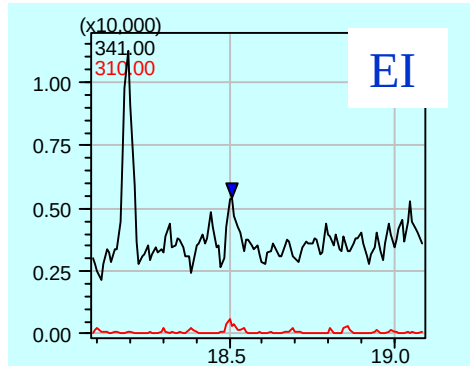
Higher sensitivity in NCI

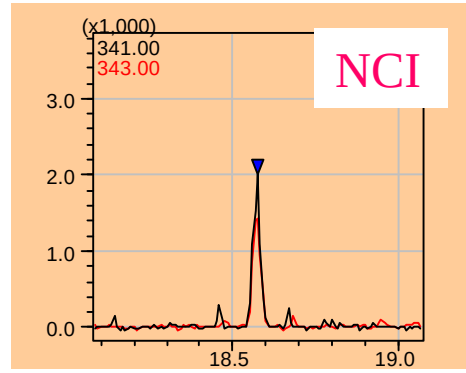
EPN(0.05µ g/ml)



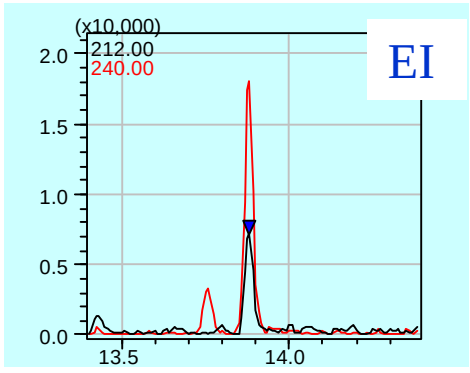


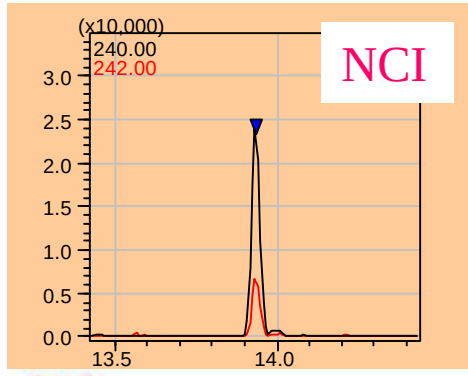
Bifenox(0.025µ g/ml)



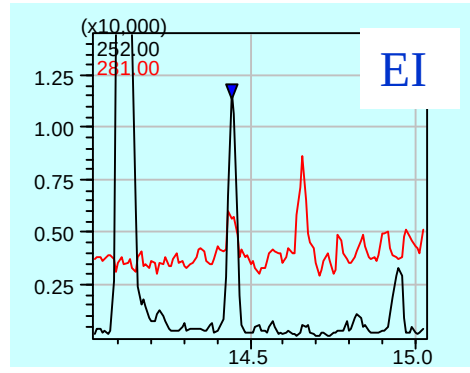


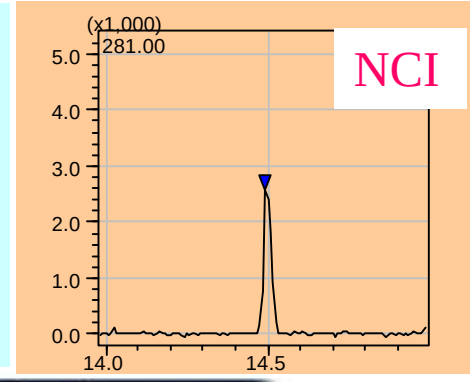
Cyanazin(0.01µ g/ml)





Pendimethalin(0.025µ g/ml)

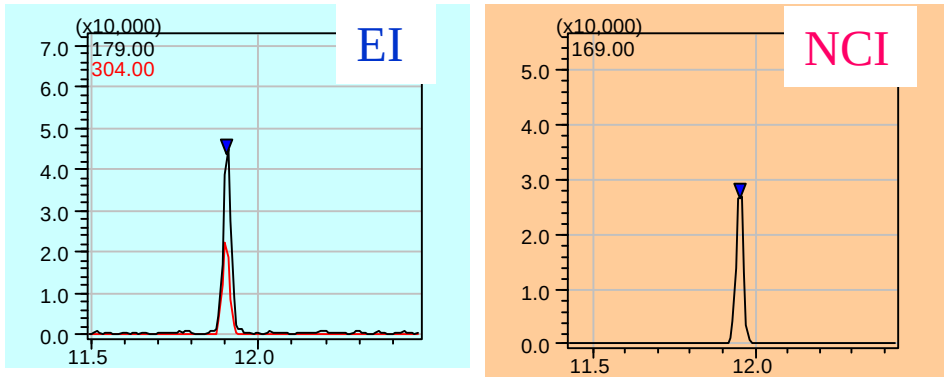




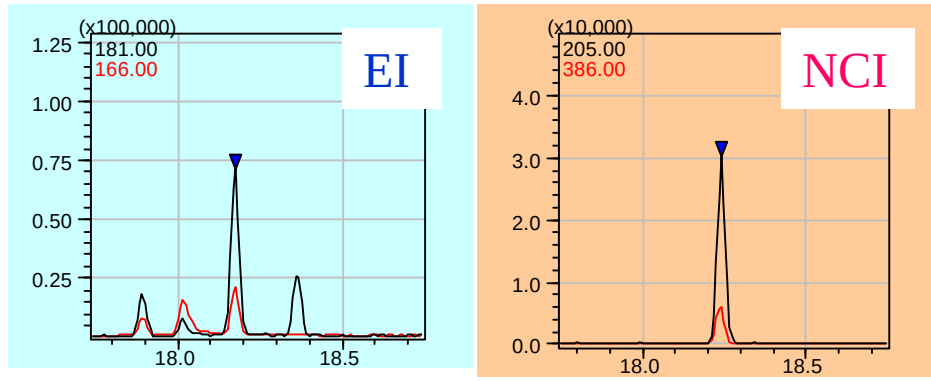
Comparison of Sensitivity NCI/EI

Simliar sensitivity

Diazinon(0.05μ g/ml)

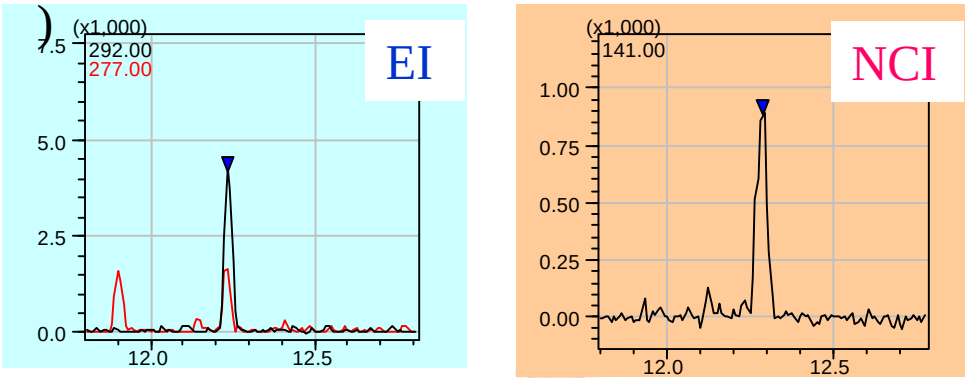


Bifenthrin(0.025μ g/ml)

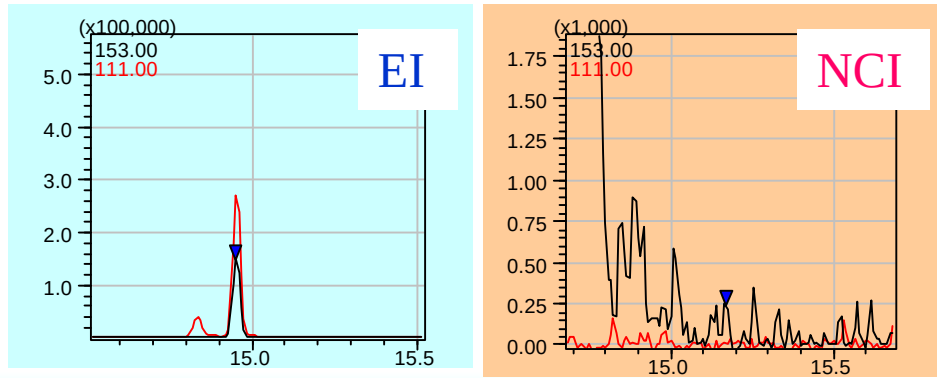


Higher sensitivity in EI

Etrimfos(0.005μ g/ml)

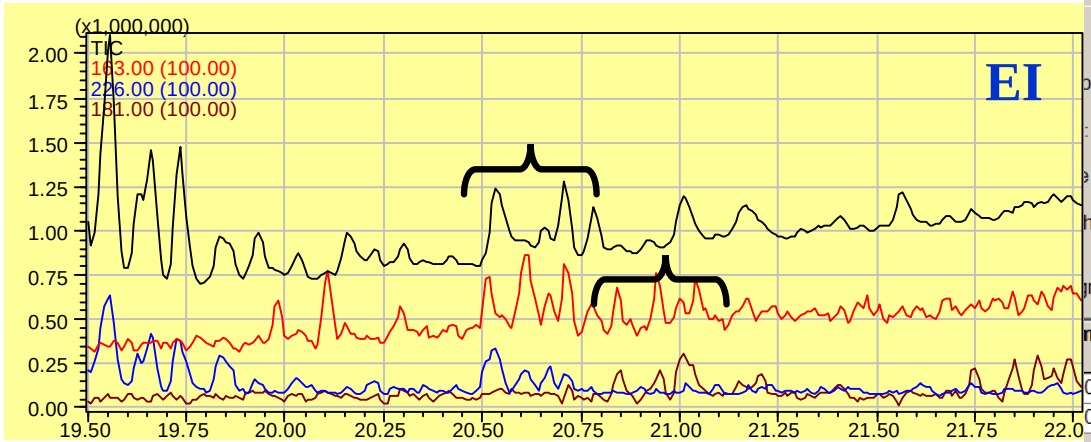


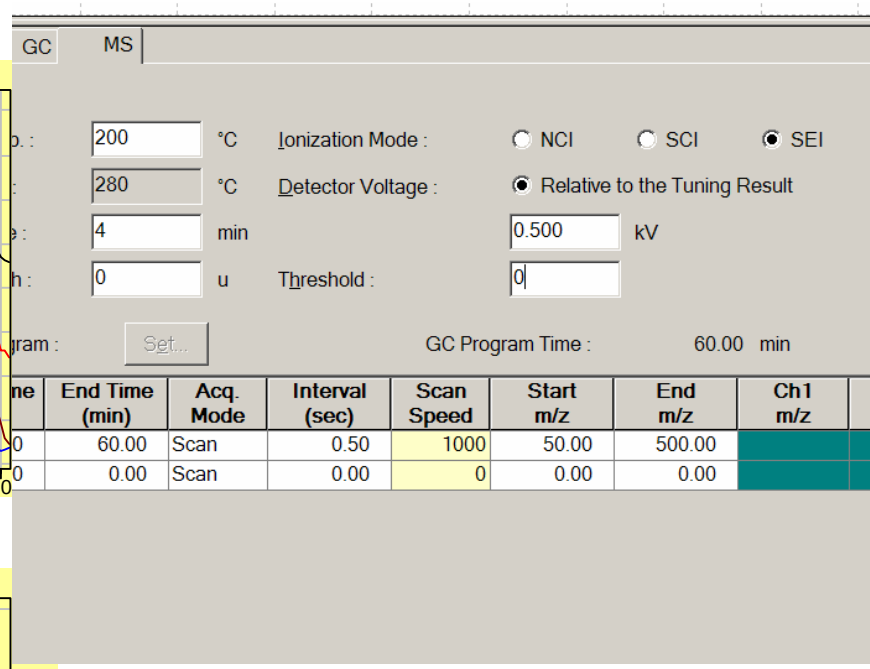
Methoprene(1.0μ g/ml)

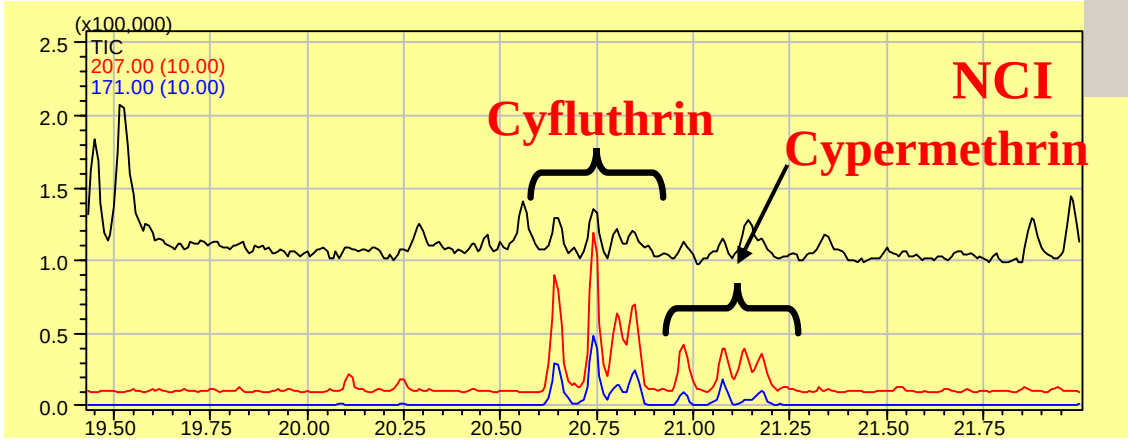


Advantages of NCI

Cyfluthrin 0.5ppm, Cypermethrin 0.25ppm







Combined

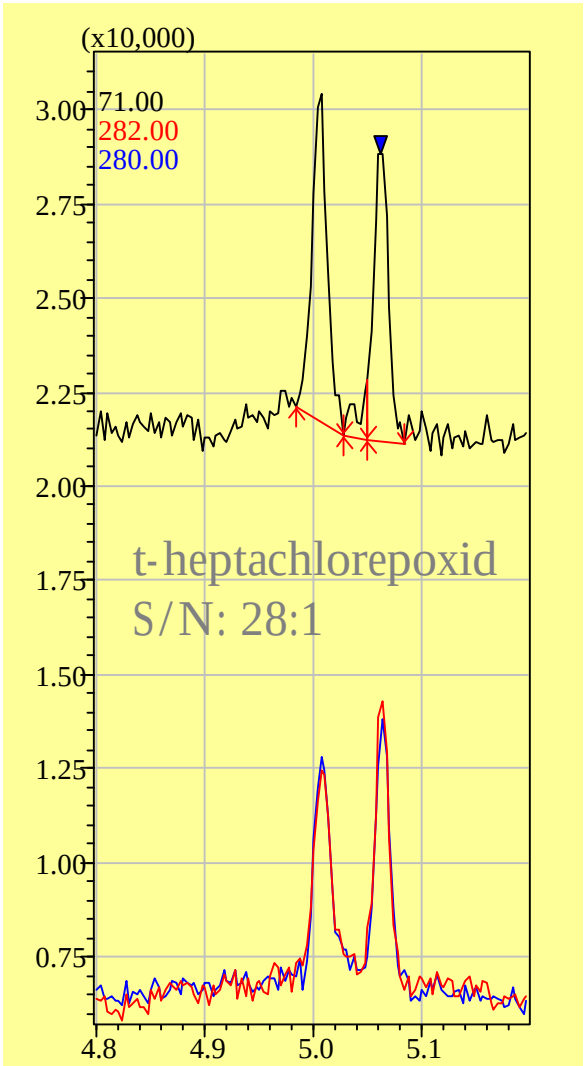
NCI/EI Library available

Comparison of the sensitivities in EI and NCI

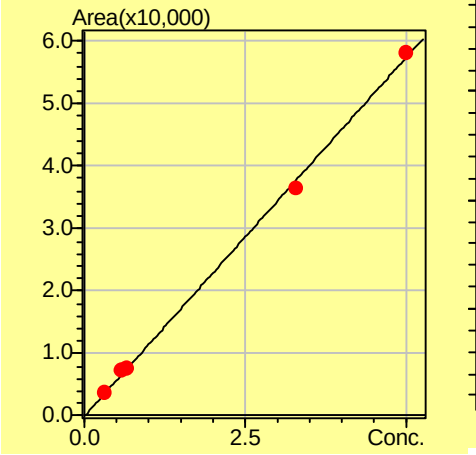
Higher sensitivity in NCI mode ← | → **Higher sensitivity in EI mode**

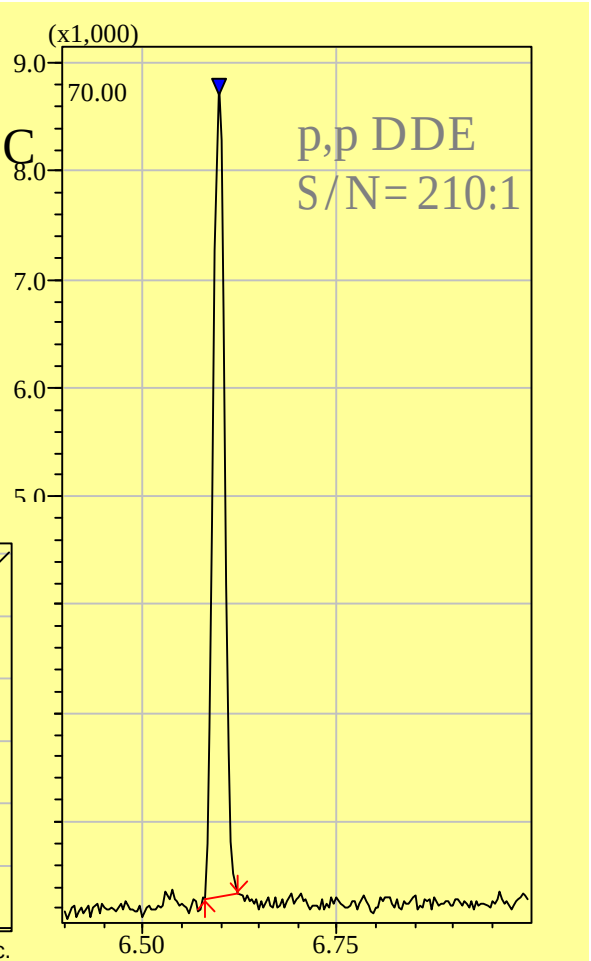
>10 times	2-10 times		Equality			>10 times	
Bifenox	Dichlofluanid	Dicofol bunkaibutu	p,p'-DDT	Aldrin	Fosthiazate	Chlofentezine deg	Mepronil
Fenvalerate	Fenalimol	malathion	Dimethoate	Thiobencarb	Acephate	Methamidophos	Propiconazol
Chlorfenapyr	Pendimethalin	Parathion	delta.-Lindane	Permethrin	Terbacil	EPTC	Lenacil
Cyfluthrin	Dieldrin	Dimethylvinphos	Cafenstrole	Pyributicarb	Pyraclofos	Propamocarb	Tebuconazole
Pyrethrin-2	Edifenphos	Pyrifenox-Z	Fluvalinate-1	p,p'-DDD	Penconazol	Chlorpropham	Etoxazole
MEP	Tefluthrin	Parathion-methyl	Pyrifenox-E	Chlopyrifos	Uniconazolep	Terbufos	Tebufenpyrad
EPN	Cypermethrin	Kresoxim-methyl	Diflufenican	Bitertanol	Fensulfothion	Benfuresate	Pyriproxyfen
Fenpropathrin	Thifluzamide	Folpet	Hxaconazole	Isofenphos	Cyhalofop-buthyl	Dimethenamid	Pyrimidifen
Acrinthrin	Acetamiprid	Cyanazine	Thiometon	Quinalphos	Butachlor	Alachlor	Mefenacet
Trifluralin	PAP ; Phenthoate	Cadusafos	Diazinon	p,p'-DDE		Metolachlor	Triadimenol
Phosalone	Pyrethrin-1	Tolclofos methyl	Prothiofos	Pirimiphos-methyl		Diethofencarb	Etrimfos
Cyhalothrin	Endrin	Pretilachlor	Difenoconazole	o,p'-DDT		Fenthion	Chlorobenzilate
ß-CVP	Deltamethrin	Malathion	Pyridaben	Halfenprox		Fludioxonil	Esprocarb
Flucythrinate	beta.-BHC	Captafol	Teraconazole	Ethoprophos		Methoprene	Thenylchlor
Butamifos	alpha.-BHC	Flutolanil	Chinomethionate	Dichlorvos		Paclobutrazol	Tricyclazole
gamma.-BHC			Bifenthrin			Flusilazole	Isoprocarb
Captan			Inabenfide			Cyproconazole	
Imibenconazole			Myclobutanil				

OCP´s with fast NCI/GCMS



SPB-5 10m, 0.1 mm, 0.1µm
80 °C,1 min, 60°C/min 200 °C
25 °C/min 280 °C
He, 50 cm/s
SIM: 0.6 ppb

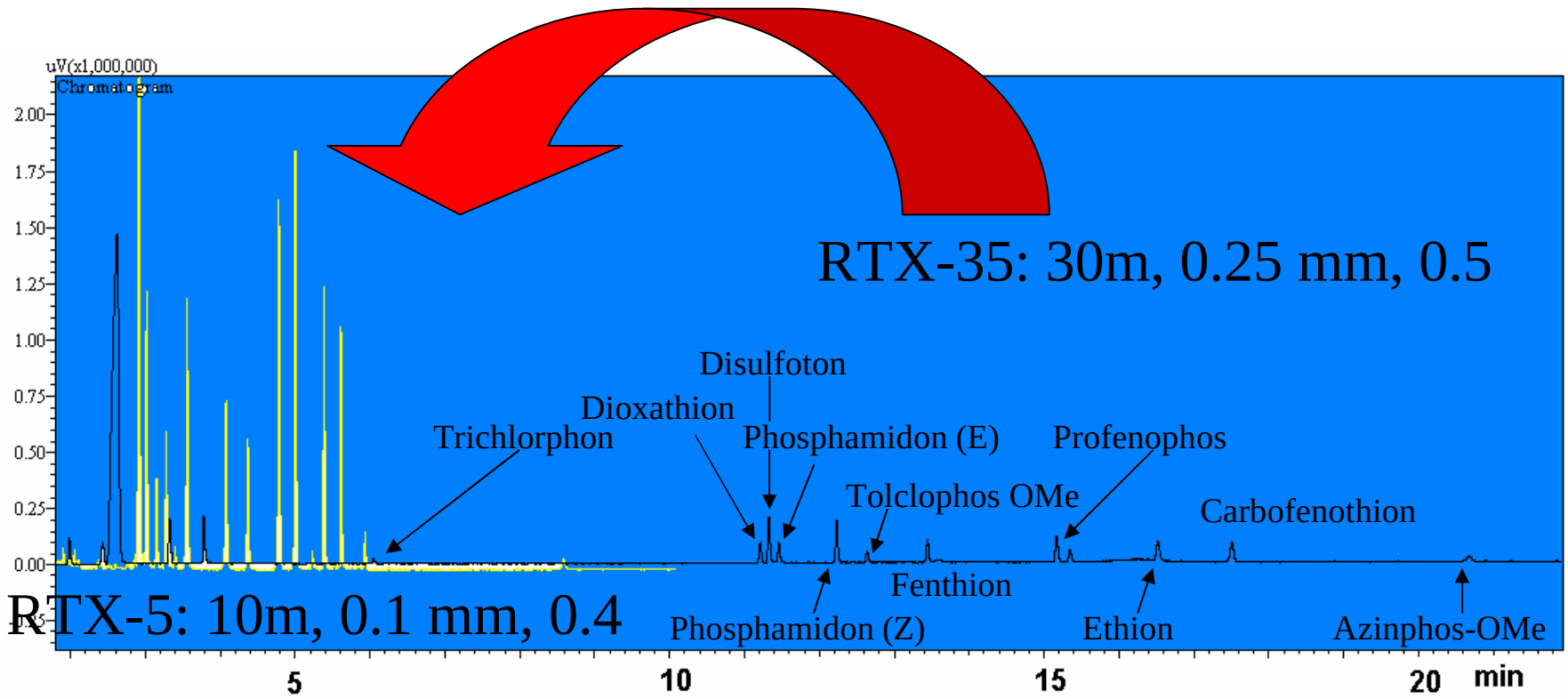




STD vs fast

Phospor Pesticides: GC-FPD

Splitless analysis



Transfer to fast: EI

Program : Column Oven Temperature

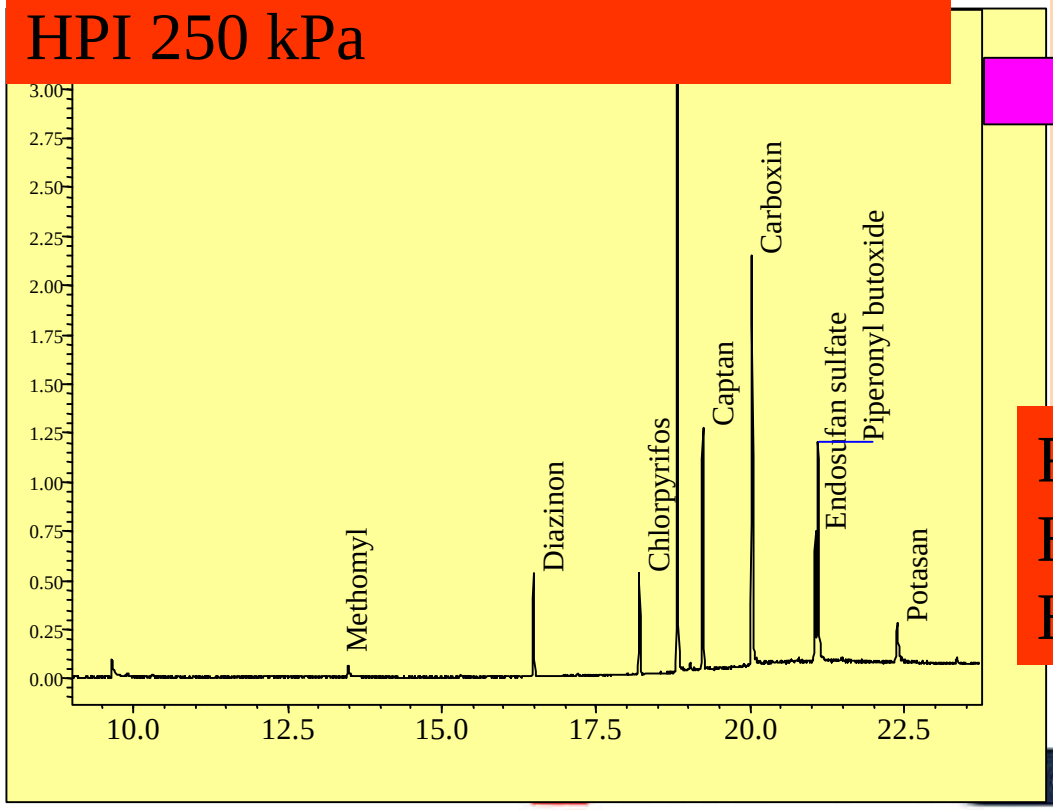
	Rate	Final Temperature	Hold Time
0	-	50.0	1.00
1	60.00	280.0	1.00
2	0.00	0.0	0.00
3	0.00	0.0	0.00

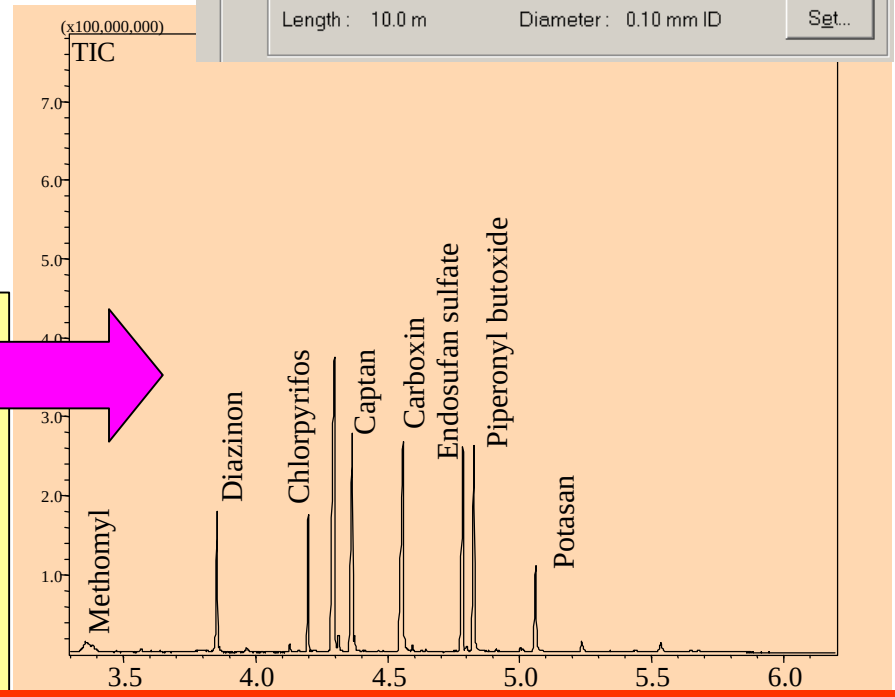
Total Program Time : 5.83 min

Column

Length : 10.0 m Diameter : 0.10 mm ID Set...

RTX-5: 30m, 0.25 mm, 0.25 µm
He 35 cm/sec, splitless 1 µl,
HPI 250 kPa

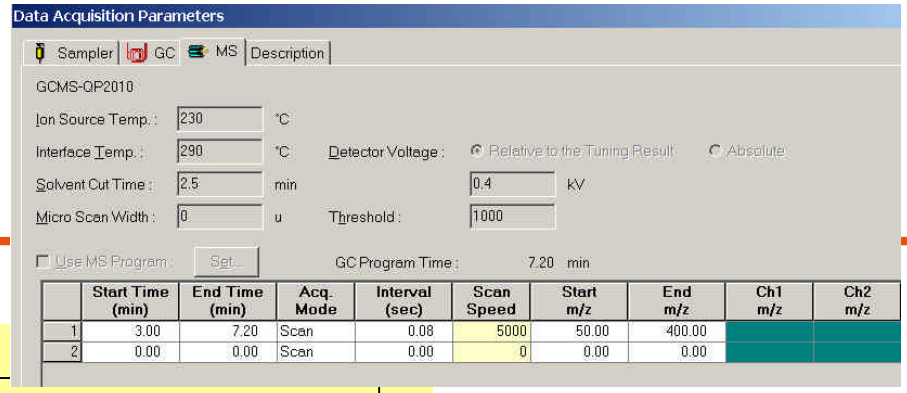


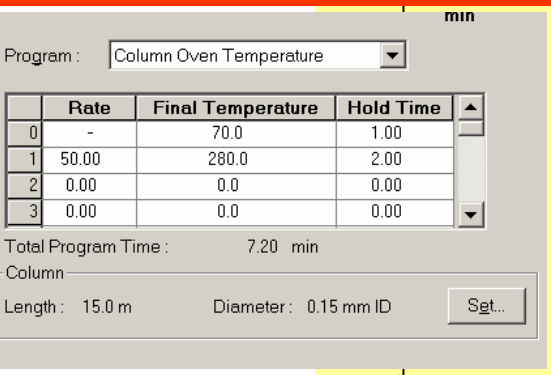


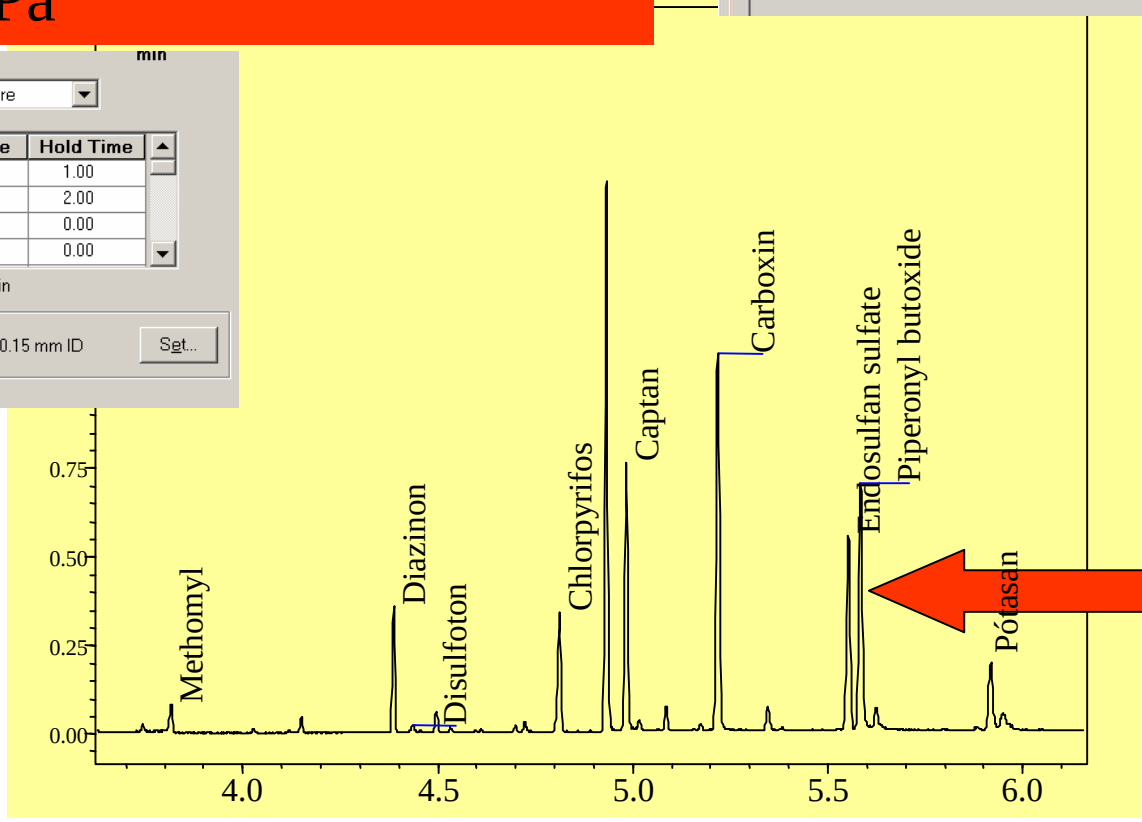
RTX-5: 10m, 0.1 mm, 0.1 µm
He 60 cm/sec, splitless 1 µl
HPI=600kPa

olutions for Science

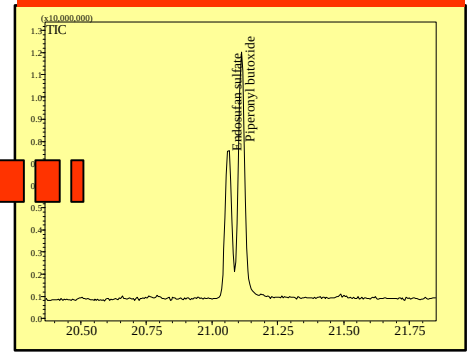
RTX-5: 10m, 0.15 mm, 0.15 µm
He 35 cm/sec, splitless 1 µl,
HPI=450kPa







30 m column



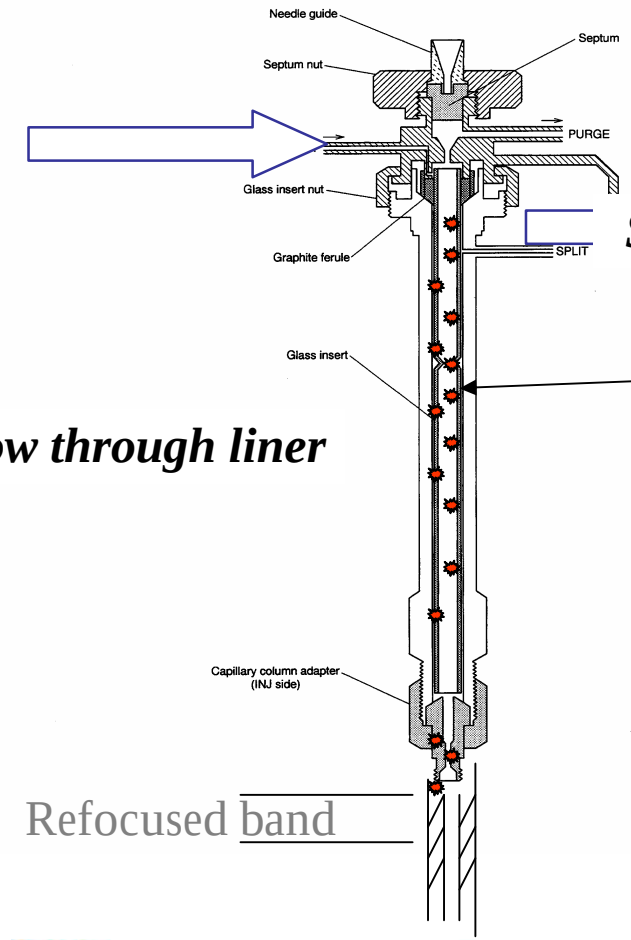
Speed gain with better resolution » 4

SHIMADZU Solutions for Science

Fast -Sample Transfer

Sample transfer in an SPL injector

Typ Liner vol ~ 1 ml
Vapour of 1 µl injected
Between 300-600 µl



Split

Filled liner with sample

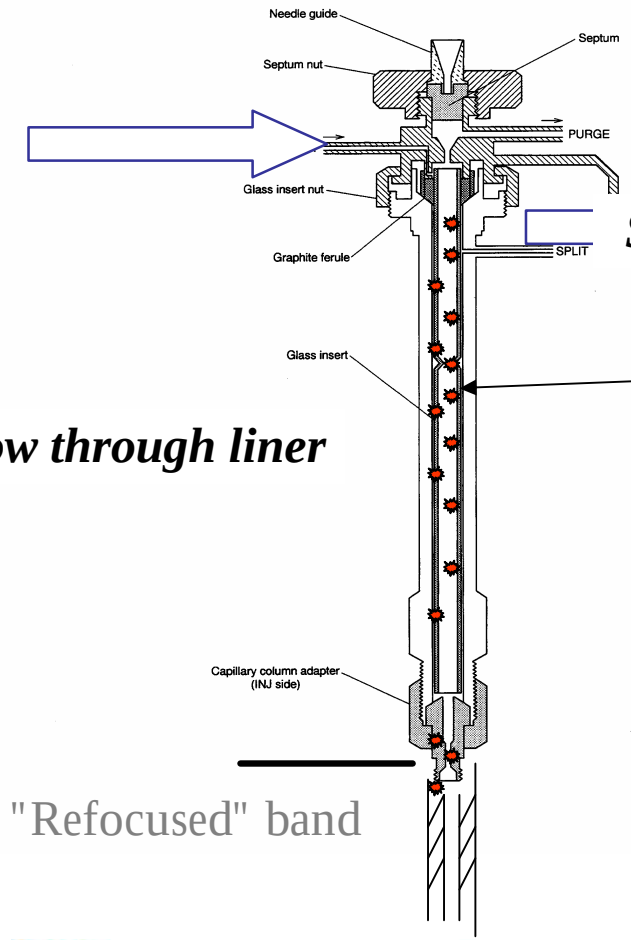
Flow through liner

Refocused band

Fast -Sample Transfer

Sample transfer in an SPL injector

Typ Liner vol ~ 1 ml
Vapour of 1 µl injected
Between 300-600 µl



Split

Filled liner with sample

Flow through liner

"Refocused" band

Compensation:
High pressure injection
HPI
And/or small ID liner

Fast GCMS-Detector

Users need for fast GCMS

1. ***- Data Aquisition rate (Sampling Frequency)***
2. ***- Mass Range (Scan speed)***

GCMS-QP2010

Speed and sampling frequency:

GCMS-QP2010

Ion Source Temp. : 200 °C

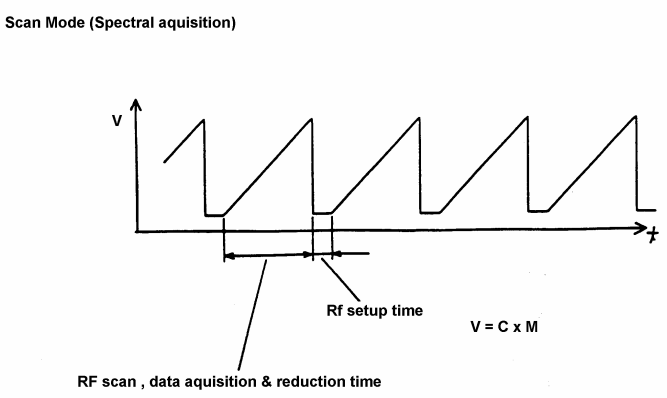
Interface Temp. : 250 °C Detector Voltage : ◉ Relative to the Tuning Result ○ Absolute

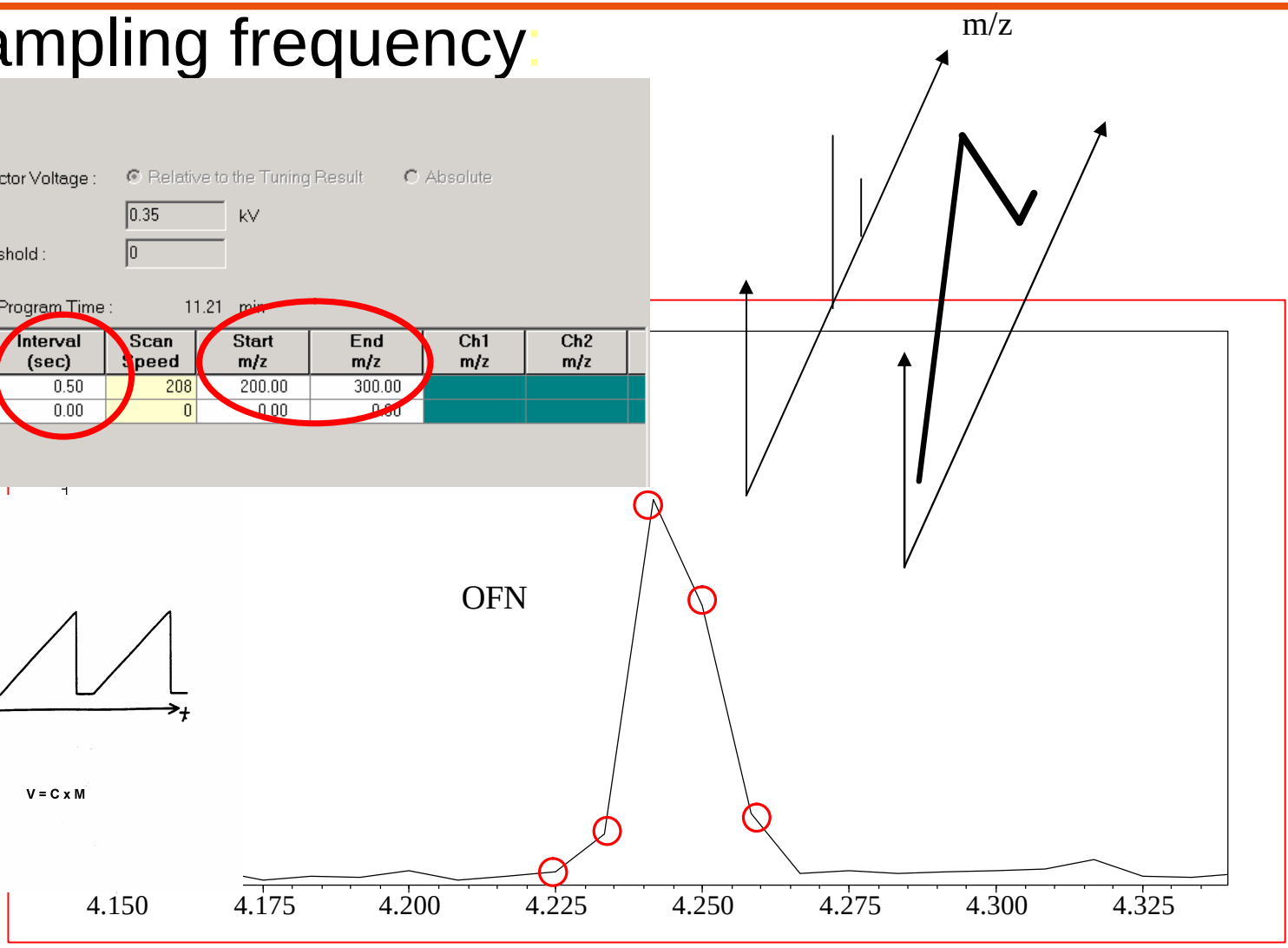
Solvent Cut Time : 3 min 0.35 kV

Micro Scan Width : 0 u Threshold : 0

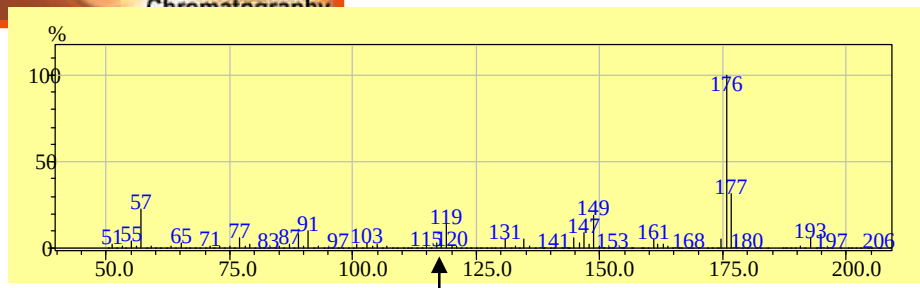
☐ Use MS Program : Set... GC Program Time : 11.21 min

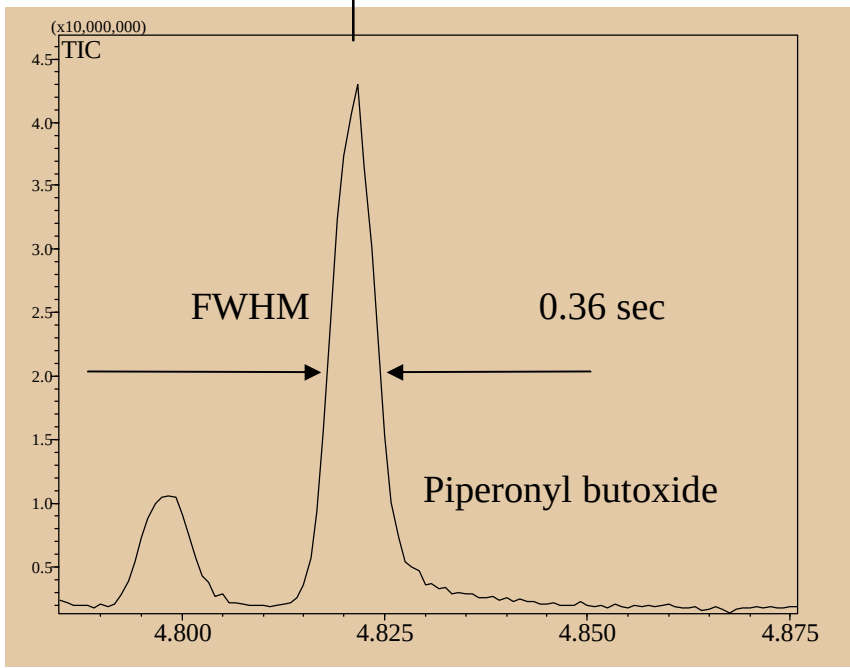
	Start Time (min)	End Time (min)	Acq. Mode	Interval (sec)	Scan Speed	Start m/z	End m/z	Ch1 m/z	Ch2 m/z
1	3.50	10.00	Scan	0.50	208	200.00	300.00		
2	0.00	0.00	Scan	0.00	0	0.00	0.00		





Fast GCMS Analysis



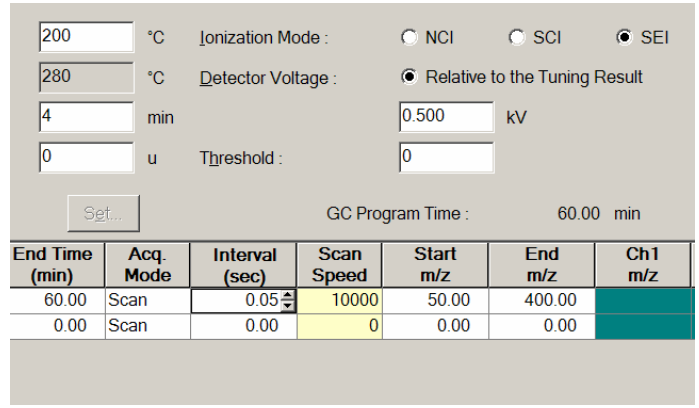


Scan range 50-400 amu
20 spectra/sec

Fast GCMS Analysis needs:

1. High speed Quad scan and low Rf setup time ⇨
2. High No of spectra/sec FWHM 0.1-0.5 sec: sampling ≥ 20 Hz [2]

[2] J. V. Hinshaw, LCGC (2002)vol 15 p. 152



Low interscan setup time needed

Fast GCMS

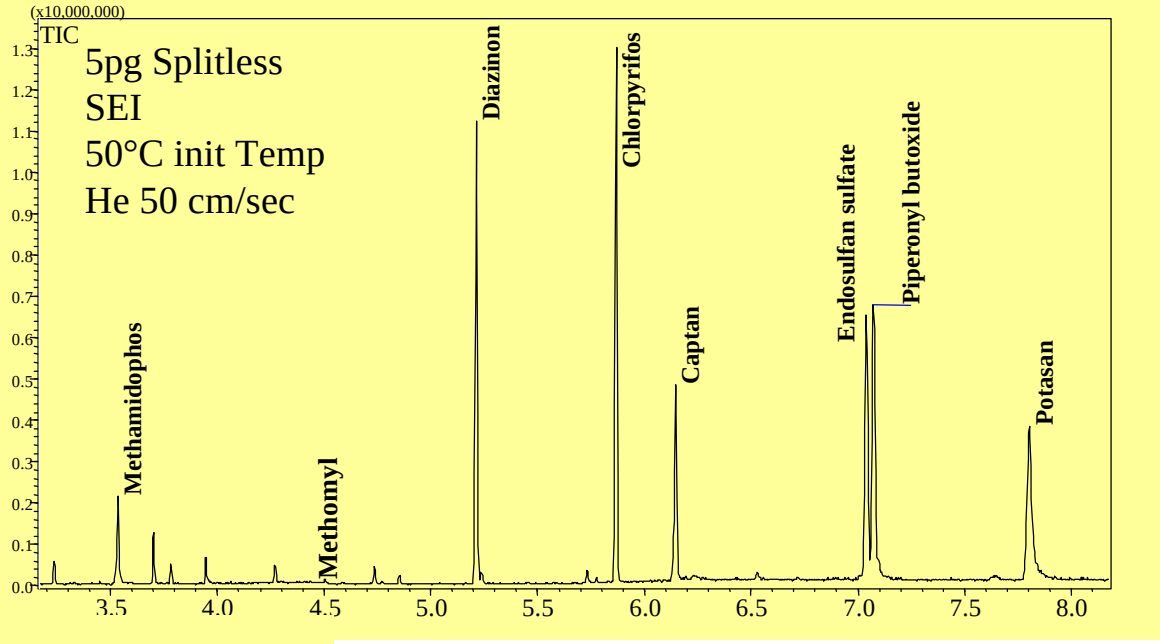
Program : Column Oven Temperature

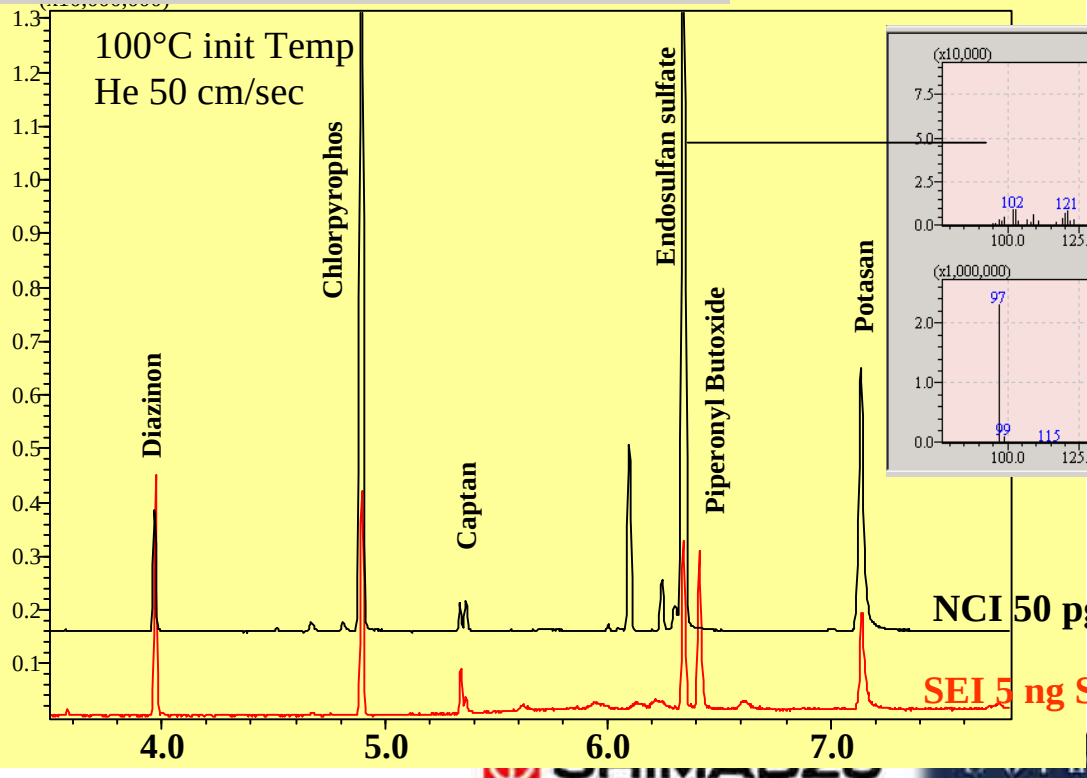
	Rate	Final Temperature	Hold Time
0	-	50.0	1.00
1	50.00	220.0	0.00
2	20.00	240.0	0.00
3	50.00	280.0	4.00

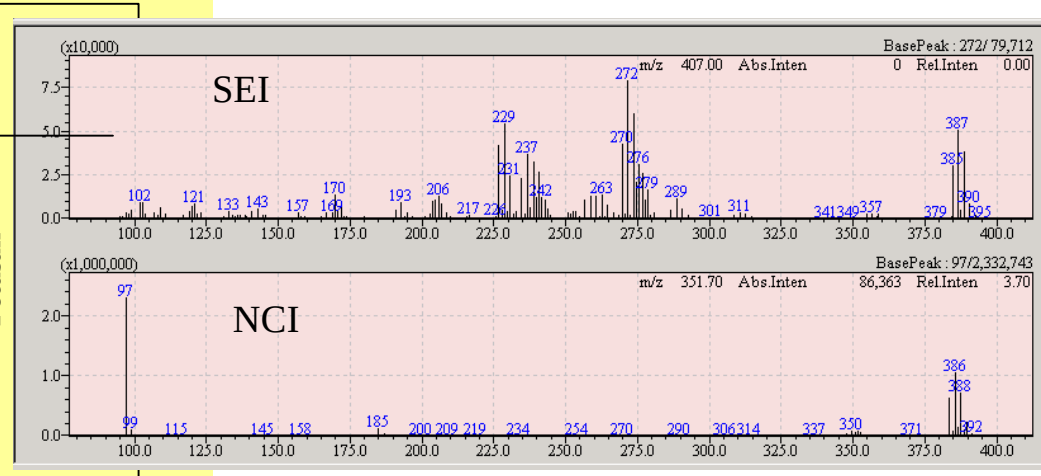
Total Program Time : 10.20 min

Column

Length : 10.0 m Diameter : 0.10 mm ID Set...





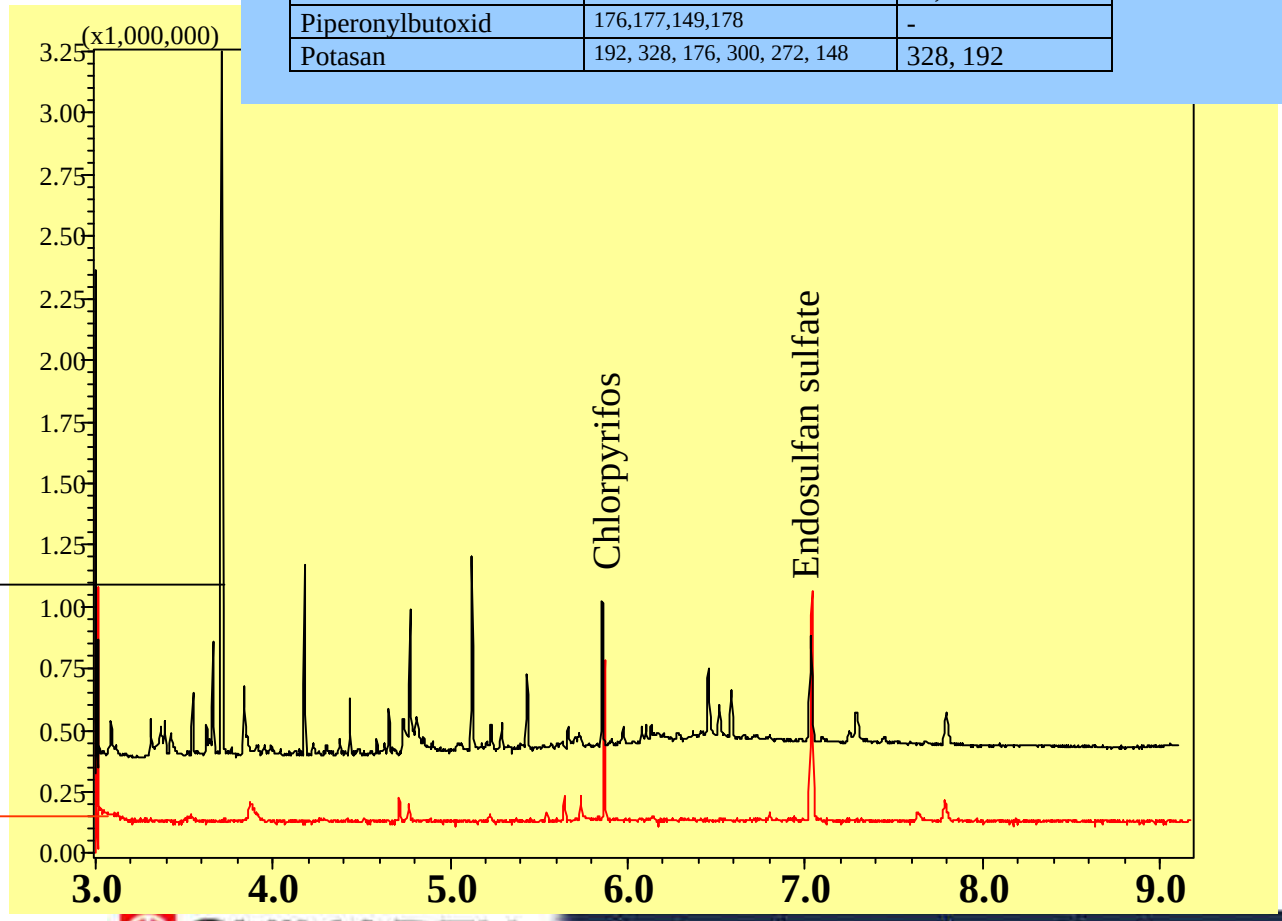


Scan 50 – 400 amu
10000 amu/sec

Fast GCMS NCI Scan

Scan 50 – 400 amu
10000 amu/sec

Substance	EI Peaks (Da)	NCI Peaks (Da)
Methamidophos	94,141,126,111,110,128	-
Methomyl	58,105,88,73,115,162	-
Diazinon	304,179,137,152,276,199	169
Chlorpyriphos-OEt	314,187,258,244,97,125,351	313,315,212,214
Captan	79,117,149,264,301,182,236	150, 149
Endosulfansulfat	229,272,239,207,170,387	97,386
Piperonylbutoxid	176,177,149,178	-
Potasan	192, 328, 176, 300, 272, 148	328, 192



Black Tea

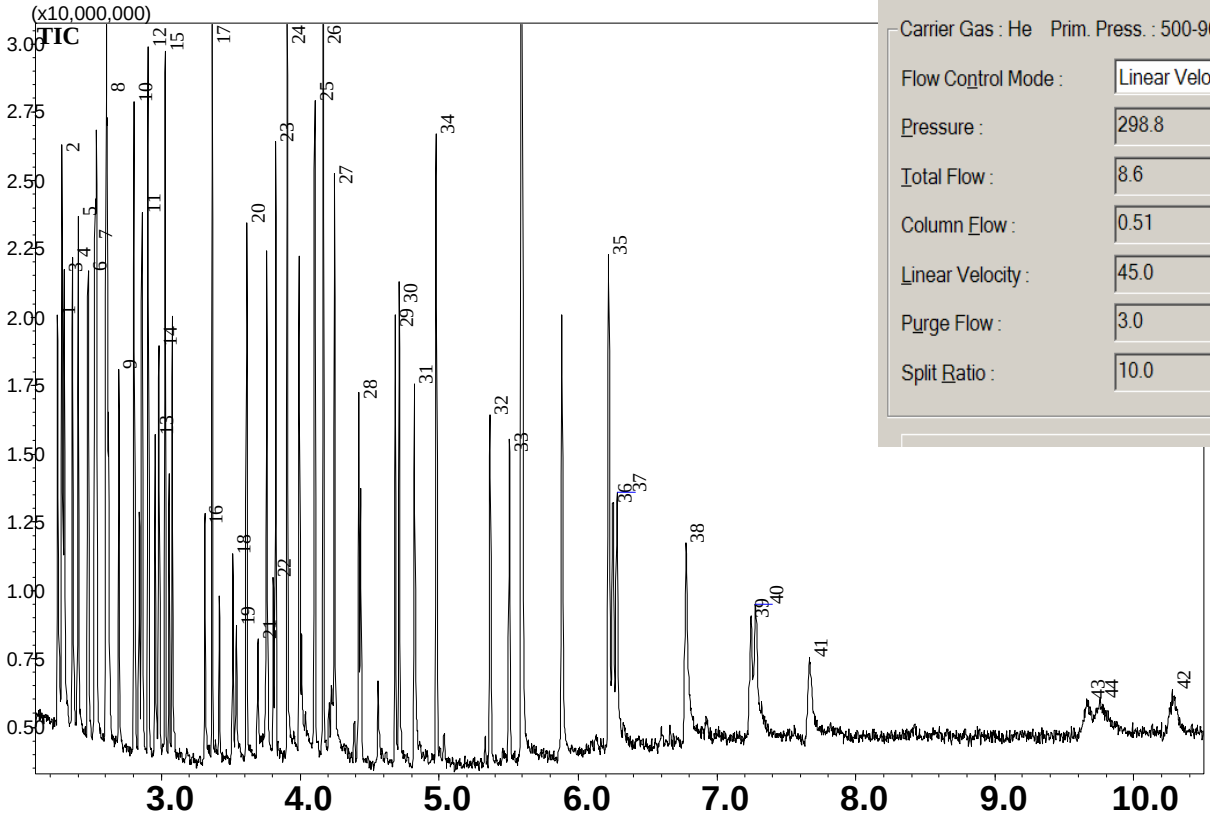
Mix 0.5 pg

Fast GCMS

What about stability in fast GCMS?

Chromatography

EPA 625 ~100 ppb each



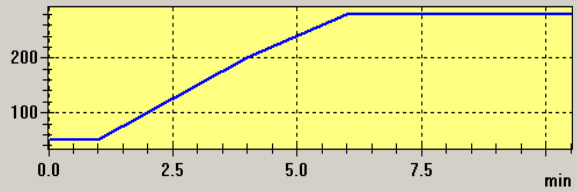
Inj. Port : SPL1 Inj. Heat Port : INJ1

Column Oven Temp. : 50.0 °C

Injection Temp. : 250.0 °C

Injection Mode : Split

Sampling Time : 1.00 min



Carrier Gas : He Prim. Press. : 500-900

Flow Control Mode : Linear Velocity

Pressure : 298.8 kPa

Total Flow : 8.6 mL/min

Column Flow : 0.51 mL/min

Linear Velocity : 45.0 cm/sec

Purge Flow : 3.0 mL/min

Split Ratio : 10.0

Program : Column Oven Temperature

	Rate	Final Temperature	Hold Time
0	-	50.0	1.00
1	50.00	200.0	0.00
2	40.00	280.0	4.50
3	0.00	0.0	0.00

Total Program Time : 10.50 min

Column

Name : BPX-5 Thickness : 0.10 um

Length : 10.0 m Diameter : 0.10 mm

Set...

Full scan

20-550 amu, 20 Hz

Stability-fast (~100 ppb each)

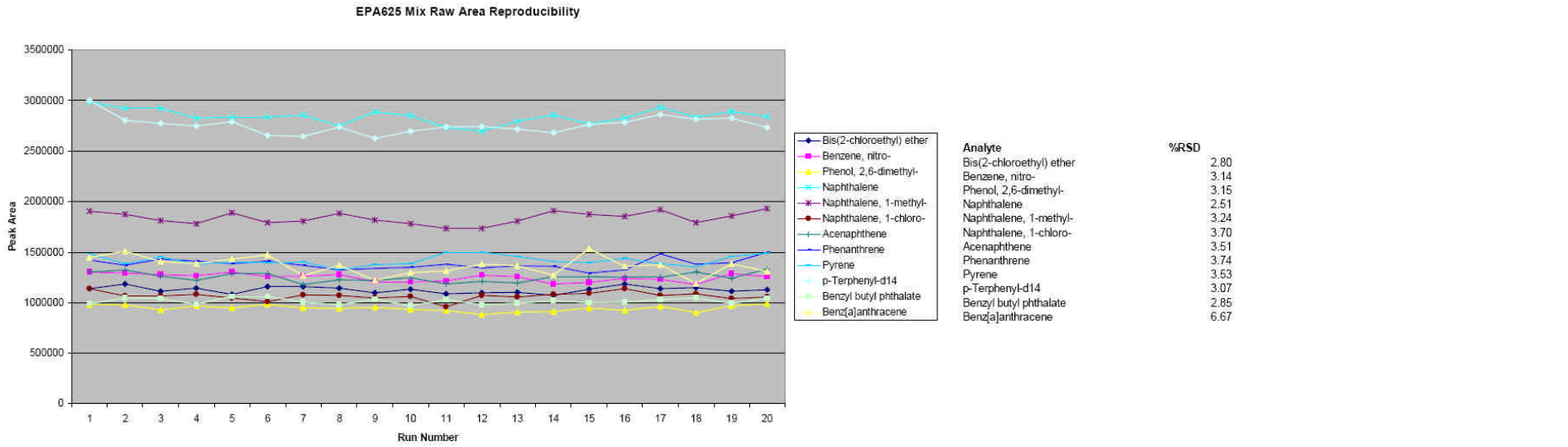
Adobe Acrobat Professional - [EPA625 repro 20 runs.pdf]

Datei Bearbeiten Anzeige Dokument Werkzeuge Erweitert Fenster Hilfe

Öffnen Speichern Drucken E-Mail Suchen PDF erstellen Überprüfen und kommentieren Schützen Unterschreiben Erweiterte Bearbeitung

Textauswahl 125% Verfahren...

Lesezeichen Unterschriften Ebenen Seiten Kommentare



Analyte	%RSD
Bis(2-chloroethyl) ether	2.80
Benzene, nitro-	3.14
Phenol, 2,6-dimethyl-	3.15
Naphthalene	2.51
Naphthalene, 1-methyl-	3.24
Naphthalene, 1-chloro-	3.70
Acenaphthene	3.51
Phenanthrene	3.74
Pyrene	3.53
p-Terphenyl-d14	3.07
Benzyl butyl phthalate	2.85
Benz[a]anthracene	6.67

[Result](Area)

ID	Compound Name	Data1 Area	Data2 Area	Data3 Area	Data4 Area	Data5 Area	Data6 Area	Data7 Area	Data8 Area	Data9 Area	Data10 Area	Data11 Area	Data12 Area	Data13 Area	Data14 Area	Data15 Area	Data16 Area	Data17 Area	Data18 Area	Data19 Area	Data20 Area	%RSD
1	Bis(2-chloroethyl) ether	1139146	1182013	1113967	1140150	1081284	1156212	1157437	1141603	1097458	1134800	1084879	1093910	1099428	1073088	1133019	1181439	1135308	1149493	1110825	1125086	2.800055
2	Benzene, nitro-	1302209	1293751	1277378	1265401	1304548	1255351	1259185	1275717	1204911	1205095	1214270	1273076	1257205	1183900	1197120	1239604	1230515	1180878	1288636	1254203	3.138704
3	Phenol, 2,6-dimethyl-	978189	978573	928713	965756	948693	985203	948429	943077	954209	933592	923718	881751	906525	910305	949083	921430	961842	903246	969065	986697	3.151739
4	Naphthalene	2985789	2924721	2923380	2823348	2835181	2838027	2857065	2749656	2887519	2851990	2734718	2699079	2796434	2857646	2771581	2824102	2935657	2833813	2892657	2840839	2.505205
5	Naphthalene, 1-methyl-	1906481	1871430	1812136	1780756	1887999	1793750	1807288	1882923	1817975	1779292	1736723	1734559	1806929	1910170	1871317	1855120	1918742	1791335	1859344	1930235	3.236435
6	Naphthalene, 1-chloro-	1138420	1064761	1065953	1081402	1042602	1009634	1073994	1068691	1042665	1060085	956554	1069941	1054127	1082008	1090521	1139115	1071928	1085186	1038027	1056149	3.697509
7	Acenaphthene	1303802	1321125	1258952	1217638	1287686	1287652	1180234	1227517	1220457	1248052	1183998	1209921	1196095	1257092	1257753	1250895	1248339	1303225	1238657	1331505	3.512076
8	Phenanthrene	1419342	1369792	1432920	1411606	1384106	1412126	1369788	1322488	1336174	1351019	1377767	1341298	1364389	1356788	1290405	1323336	1484040	1379111	1394817	1495557	3.736534
9	Pyrene	1482999	1384321	1453515	1377824	1399664	1394922	1402123	1325805	1375134	1384355	1499860	1496656	1458771	1405967	1394787	1438547	1383354	1354634	1455810	1485655	3.534234
10	p-Terphenyl-d14	3002355	2806976	2772407	2748027	2791826	2656789	2647677	2738546	2626883	2699311	2735666	2745378	2715154	2679470	2764430	2784463	2863471	2816936	2827847	2731681	3.074156
11	Benzyl butyl phthalate	986574	1043926	1042076	984518	1060118	1059539	1002950	980366	1034405	966497	1030872	977567	994969	1017076	1000966	1005566	1027150	1045406	993146	1039205	2.849091
12	Benz[a]anthracene	1448135	1505592	1406853	1386661	1428460	1473169	1264298	1370526	1220048	1295750	1312497	1381680	1365872	1273519	1536075	1357571	1372074	1186648	1386109	1305926	6.6671

[Result](RT)

ID	Compound Name	Data1 RT	Data2 RT	Data3 RT	Data4 RT	Data5 RT	Data6 RT	Data7 RT	Data8 RT	Data9 RT	Data10 RT	Data11 RT	Data12 RT	Data13 RT	Data14 RT	Data15 RT	Data16 RT	Data17 RT	Data18 RT	Data19 RT	Data20 RT	%RSD
1	Bis(2-chloroethyl) ether	2.527	2.525167	2.523667	2.526167	2.5235	2.527833	2.526	2.524	2.523	2.522667	2.524333	2.523333	2.524667	2.523833	2.525	2.523333	2.522333	2.525	2.526667	2.527833	0.066269
2	Benzene, nitro-	2.932333	2.931667	2.931833	2.931667	2.932833	2.930667	2.9315	2.929	2.930167	2.930333	2.930333	2.932167	2.931	2.928833	2.931333	2.930333	2.9315	2.931667	2.930833	2.934	0.041563
3	Phenol, 2,6-dimethyl-	3.086833	3.0865	3.085667	3.085167	3.0855	3.0855	3.085833	3.085167	3.086333	3.084833	3.084	3.083833	3.084833	3.084833	3.086	3.085333	3.086	3.085333	3.085167	3.085167	0.024365
4	Naphthalene	3.2655	3.264333	3.263833	3.263833	3.265167	3.265333	3.265833	3.2645	3.265833	3.264833	3.266167	3.265	3.263833	3.264	3.265333	3.265167	3.264833	3.265833	3.266333	3.265833	0.024531
5	Naphthalene, 1-methyl-	3.6065	3.603667	3.603667	3.604333	3.6045	3.603833	3.604667	3.6045	3.605	3.602333	3.6035	3.604667	3.6035	3.6045	3.605333	3.606	3.604833	3.605	3.605	3.605167	0.026125
6	Naphthalene, 1-chloro-	3.857333	3.8535	3.854167	3.855	3.856	3.853833	3.854667	3.855333	3.856167	3.854167	3.854333	3.853333	3.8535	3.852333	3.856167	3.853833	3.853833	3.856333	3.855	3.855667	0.032817
7	Acenaphthene	4.149	4.15	4.151167	4.149	4.151333	4.151167	4.15	4.150167	4.149	4.151167	4.152167	4.150667	4.151167	4.151333	4.151667	4.151667	4.1515	4.1515	4.150167	4.150167	0.023107
8	Phenanthrene	4.91	4.907167	4.907	4.909333	4.905667	4.91	4.9085	4.9085	4.91	4.91	4.91	4.9095	4.907	4.908667	4.908667	4.9085	4.908333	4.907	4.908667	4.9075	0.025859
9	Pyrene	5.521167	5.515333	5.516833	5.518333	5.518167	5.5195	5.517	5.517	5.519167	5.5185	5.5155	5.518333	5.517667	5.517167	5.5195	5.5185	5.517	5.518667	5.519833	5.518667	0.026046
10	p-Terphenyl-d14	5.707167	5.705	5.703333	5.7045	5.705333	5.704333	5.705833	5.704333	5.704833	5.7045	5.704	5.705167	5.704833	5.704667	5.706167	5.706167	5.704833	5.7045	5.704667	5.702167	0.018572
11	Benzyl butyl phthalate	5.971833	5.969167	5.967333	5.966833	5.9705	5.967333	5.9715	5.969	5.97	5.970333	5.969	5.972667	5.970667	5.970833	5.972667	5.9715	5.968667	5.967167	5.968833	5.970833	0.030218
12	Benz[a]anthracene	6.458	6.450167	6.448833	6.4505	6.4545	6.451833	6.456	6.456167	6.453167	6.454333	6.45	6.450167	6.451167	6.4515	6.452	6.453167	6.453167	6.450333	6.450667	6.448333	0.039961

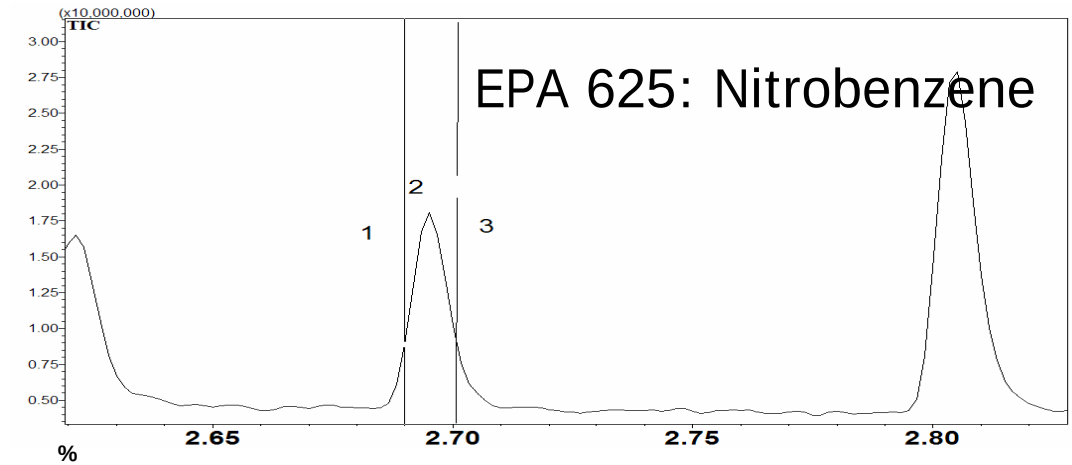
296.7 x 209.9 mm

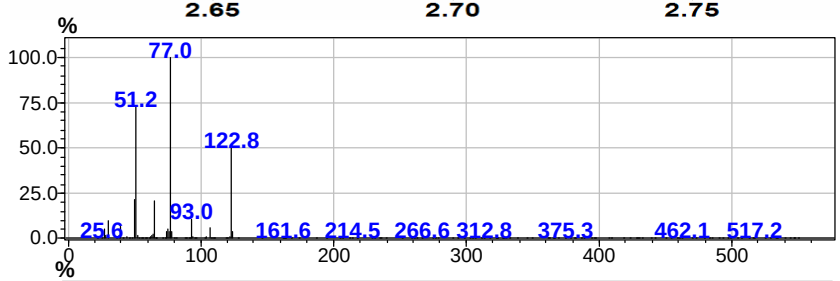
1 von 1

Fast GCMS

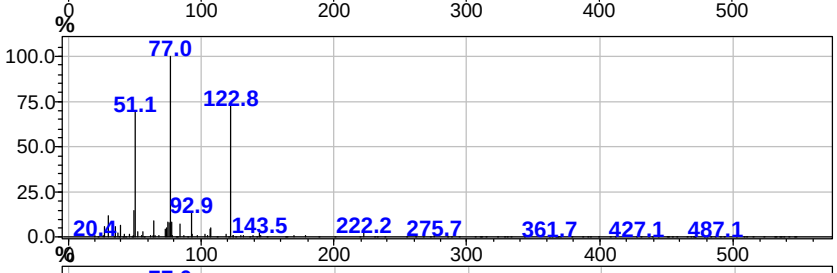
What about spectrum Quality in fast GCMS?

Spectrum Quality Fast GCMS

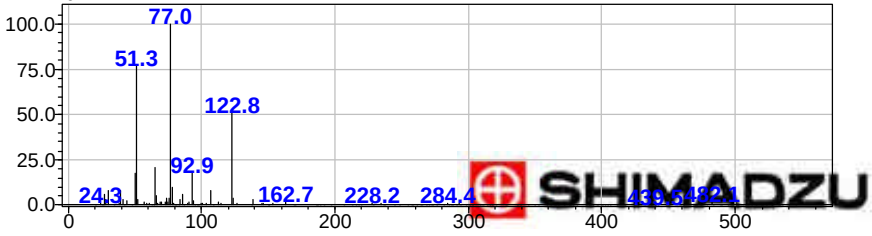




1: SI 89 Wiley



2: SI 93 Wiley



3: SI 88 Wiley

Spectrum Quality fast scanning

1. **Comprehensive two-dimensional gas chromatography in combination with rapid scanning quadrupole mass spectrometry in perfume analysis**

   Luigi Mondello *et al:*

   Journal of Chromatography A, 1067 (2005) 235–243

2. **Comprehensive Two-Dimensional Gas Chromatography coupled to rapid-scanning Quadrupole Mass Spectrometer (GC´GC–qMS): Principles and Applications**

   Mohamed Adahchour, Menno Brandt, Hans-Ulrich Baier, René J.J. Vreuls and Udo A.Th. Brinkman:

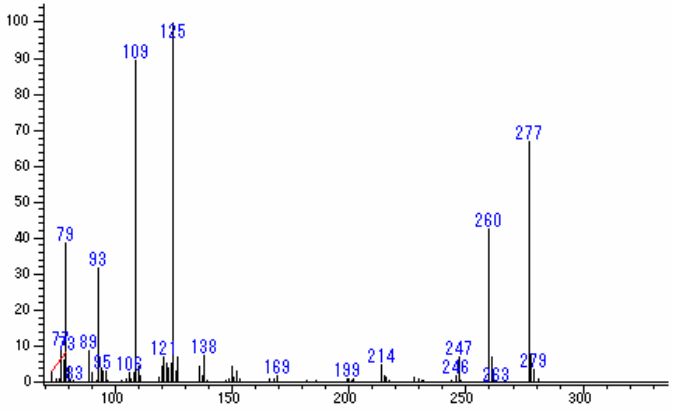
Journal of Chromatography A
Volume 1067, Issues 1-2 , 4 March 2005, Pages 245-254
Mass Spectrometry: Innovation and Application. Part IV

Inert: QP-2010 as default

Degradation of PEST in Ion source?

Fenitrothion

QP2010



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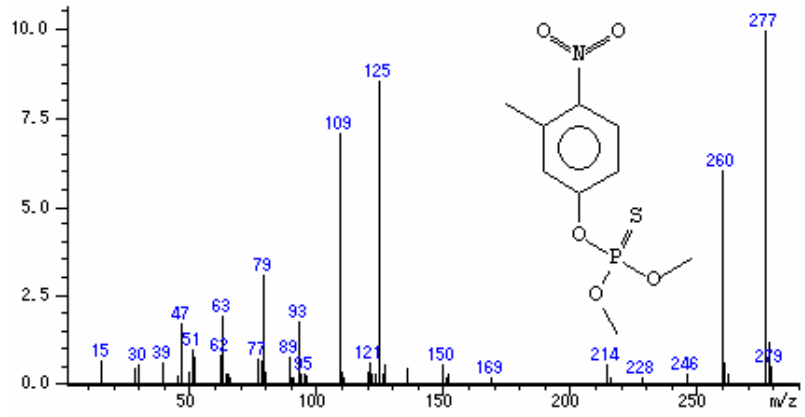
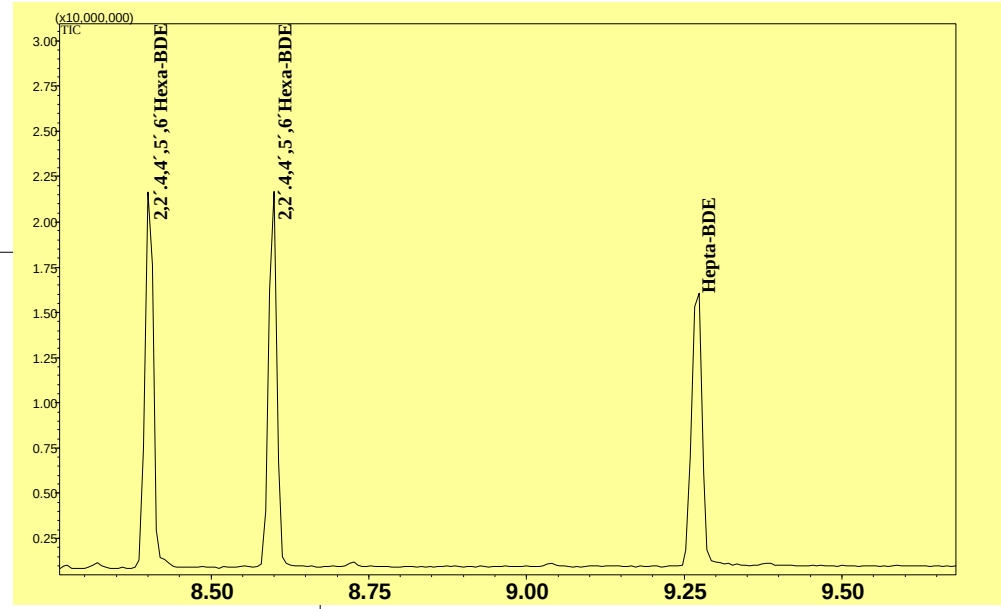
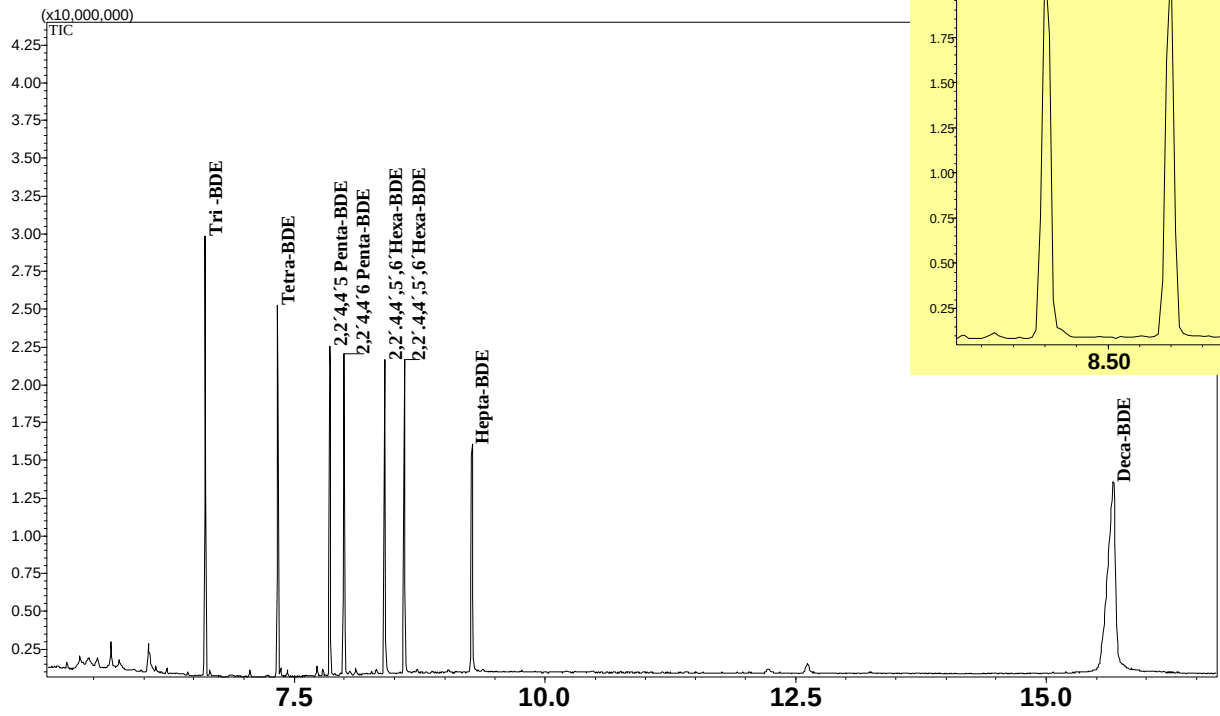


Inert: QP-2010 as default

- Data from the GCMS-QP2010
- Ion Source Temp: 200 °C





Liquid injection in SPL-2010 (270 °C)

Split 5:1, 20 ppm each, Deca 200ppm

Column: UA5-30m-0.25mm, 0.1 film (Frontier Lab)