Dynamic and Static Headspace System for Broadest Analytical Range

HT3 – Static and Dynamic Headspace System

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- Static Headspace – robust technique due to Headspace analysis providing a clean, reliable result

- Dynamic – continually sweeps the headspace of a sample, and then concentrates the analytes onto an adsorbent trap, increasing sensitivity up to 100 times

- You can switch between Static and Dynamic Headspace techniques within a single schedule
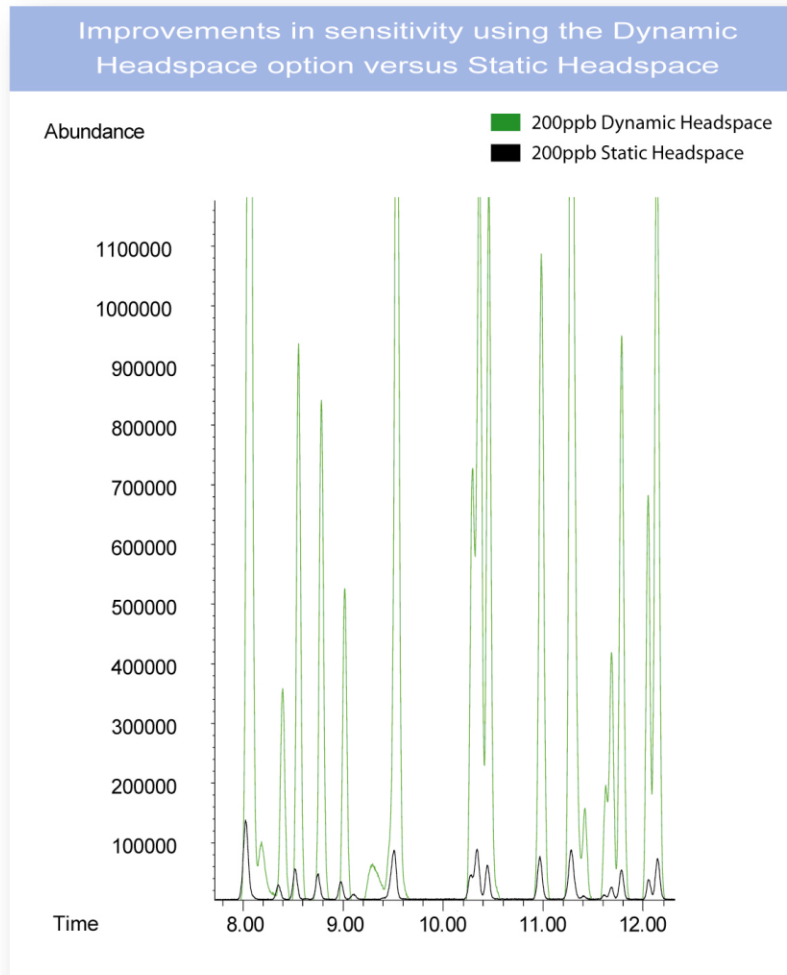
Control

- Electronic and Pressure control – Variable vial pressurization can be set as a method parameter

- Automatic static vial pressure measurements

- Loop pressure can be adjusted prior to injection into the GC

- Variable flow rates can be set between 5 and 500 mL/min

- Automatic pressure control ensures identical loop fill each time

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Control

- TekLink – Easy to use and proven Teklink software for all GC introduction systems
- Operates with Windows® 2000 or XP Pro platform
- Teklink includes method set-up safeguards that warn if parameters don't match
- Teledyne offers the Waters® Empower™ software driver for a data-secured regulatory lab

Expand = Static and Dynamic Headspace

Improvements in sensitivity using the Dynamic Headspace option versus Static Headspace

Example of 8260 standard
Same standard run on both
Static and Dynamic

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HT3 Static Parameters

Variable	Value		Variable	Value
GC Cycle Time	20.00 min		Mixing Level	Level 5
Valve Oven Temp	100 degrees C		Mixer Stabilize Time	0.50 min
Transfer line Temp	100 degrees C		Pressurize	10 PSIG
Standby Flow Rate	50 mL/min		Pressurize Time	1.50 min
Platen/Sample Temp	85 degrees C		Pressurize Equil. Time	0.50 min
Sample Equil. Time	30.00 min		Loop Fill Pressure	5 PSIG
Mixer	on		Loop Fill Time	0.50 min
Mixing Time	20.00 min		Loop Fill Equil. Time	0.50 min
			Inject Time	1.00 min

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HT3 Dynamic Parameters

Variable	Value		Variable	Value
GC Cycle Time	20.00 min		Preheat Mixing Time	2.00 min
Valve Oven Temp	150 degrees C		Preheat Mixer Stabilize Time	0.50 min
Transfer Line Temp	150 degrees C		Sweep Flow Rate	75 mL/min
Standby Flow Rate	40 mL/min		Sweep Flow Time	6.00 min
Trap Standby Temp	30 degrees C		Desorb Preheat	255 degrees C
Platen/Sample Temp	65 degrees C		Desorb Temp.	260 degrees C
Sample Preheat Time	20.00 min		Desorb Time	2.00 min
Preheat Mixer	On		Trap Bake Temp.	300 degrees C
Preheat Mixer Level	Level 5		Trap Bake Time	5.00 min
			Trap Bake Flow	450 mL/min

Subset of 8260 Compounds

Compounds	Static (Loop Curve) 200ppb to 2ppm %RSD's	Static MDL's (ppb)	Dynamic (Trap Curve) 5ppb to 100ppb %RSD's	Dynamic MDL's (ppb)
Dichlorodifluoromethane	2.50	36.24	9.08	0.58
Chloromethane	1.64	30.11	10.02	0.67
Vinyl Chloride	3.37	22.87	6.81	0.60
Bromomethane	6.60	17.63	3.90	0.95
Chloroethane	2.92	20.83	6.97	0.44
Trichloromonofluoromethane	4.03	15.29	8.47	1.16
Methylene Chloride	3.18	23.75	10.15	0.94
trans-1,2-dichloroethene	5.18	12.35	7.06	0.73
Carbon disulfide	3.42	15.03	5.74	0.48
MTBE	6.43	20.97	7.44	1.05
1,1-dichloroethane	3.26	15.65	6.36	0.64
cis-1,2-dichloroethene	3.99	19.06	5.98	0.66
Bromochloromethane	3.75	25.40	6.79	0.94
Chloroform	2.59	19.45	5.25	0.60
Carbon tetrachloride	5.01	14.48	10.05	0.65
1,1,1-trichloroethane	2.12	15.16	8.53	0.69
2-Butanone	5.86	61.59	8.44	5.32
Benzene	2.76	19.22	6.44	0.62
1,2-dichloroethane	5.04	21.53	8.98	0.91
Trichloroethene	16.59	45.97	4.15	0.52

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Compounds Continued

Compounds	Static (Loop Curve) 200ppb to 2ppm %RSD's	Static MDL's (ppb)	Dynamic (Trap Curve) 5ppb to 100ppb %RSD's	Dynamic MDL's (ppb)
Dibromomethane	4.81	23.60	4.08	0.68
1,2-dichloropropane	3.74	12.10	5.44	0.46
Bromodichloromethane	6.01	16.31	6.58	0.35
cis-1,3-dichloropropene	10.66	27.26	8.50	0.78
Toluene	2.04	13.34	5.66	0.29
Tetrachloroethene	10.35	12.40	11.30	0.82
trans-1,3-dichloropropene	12.85	30.07	9.12	0.61
1,1,2-trichloroethane	5.80	20.83	5.27	0.92
Dibromochloromethane	9.55	19.31	9.00	1.13
1,3-dichloropropane	3.93	17.16	5.50	1.01
1,2-dibromoethane	6.11	17.10	4.12	1.05
2-hexanone	5.50	48.34	10.21	1.84
Chlorobenzene	1.01	9.55	4.31	0.25
Ethyl benzene	4.03	9.45	4.89	0.45
1,1,1,2-tetrachloroethane	3.61	9.80	7.77	0.51
M&P Xylene	5.70	13.74	6.56	0.79
Ortho Xylene	2.60	10.86	6.23	0.40
Styrene	5.23	13.08	5.69	0.38
Bromoform	10.25	10.69	14.33	0.88
Isopropylbenzene	3.97	10.99	8.59	0.42

Compounds Continued

Compounds	Static (Loop Curve) 200ppb to 2ppm %RSD's	Static MDL's (ppb)	Dynamic (Trap Curve) 5ppb to 100ppb %RSD's	Dynamic MDL's (ppb)
Isopropylbenzene	3.97	10.99	8.59	0.42
n-propylbenzene	4.77	13.04	9.93	0.47
Bromobenzene	3.88	10.27	2.12	0.43
1,3,5-TMB	4.19	8.81	10.07	0.34
2-chlorotoluene	2.16	11.33	3.90	0.31
1,2,3-trichloropropane	3.38	25.30	3.87	0.58
4-chlorotoluene	2.45	14.05	5.45	0.30
Tertbutylbenzene	2.61	11.42	15.51	0.34
1,2,4-TMB	3.81	11.95	13.89	0.30
Sec-butylbenzene	6.15	11.21	15.05	0.49
p-isopropyltoluene	5.31	11.51	18.47	0.29
1,3-dichlorobenzene	2.15	13.88	4.06	0.34
1,4-dichlorobenzene	2.21	12.70	3.51	0.26
n-butylbenzene	5.54	13.22	21.85	0.25
1,2-dichlorbenzene	1.41	11.80	3.12	0.42
1,2-dibromo-3-chloropropane	9.51	24.02	11.26	0.94
Hexachlorobutadiene	2.17	9.41	13.13	0.62
1,2,4-trichlorobenzene	4.26	10.26	12.24	0.59
Naphthalene	7.09	11.43	13.13	0.79
1,2,3-trichlorobenzene	3.76	13.61	9.41	0.58

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Improve

- HT3 contains 60 position autosampler to maximize productivity and automatically determines when to load and unload samples to the platen heater

- Method Optimization Mode – analyst can optimize different method variables such as platen temp and sample equilibration time

- Improved diagnostics – Benchmark test verifies all critical electrical and mechanical components

Wide Variety of Applications

- Pharmaceutical Low-Level Solvents and impurities

- In an effort to protect the health of patients, pharmaceutical companies have adopted methodologies to analyze for solvents used in preparation of drug products

- Static Headspace achieves the detection limit requirements, however Dynamic Headspace achieves detection limits significantly lower
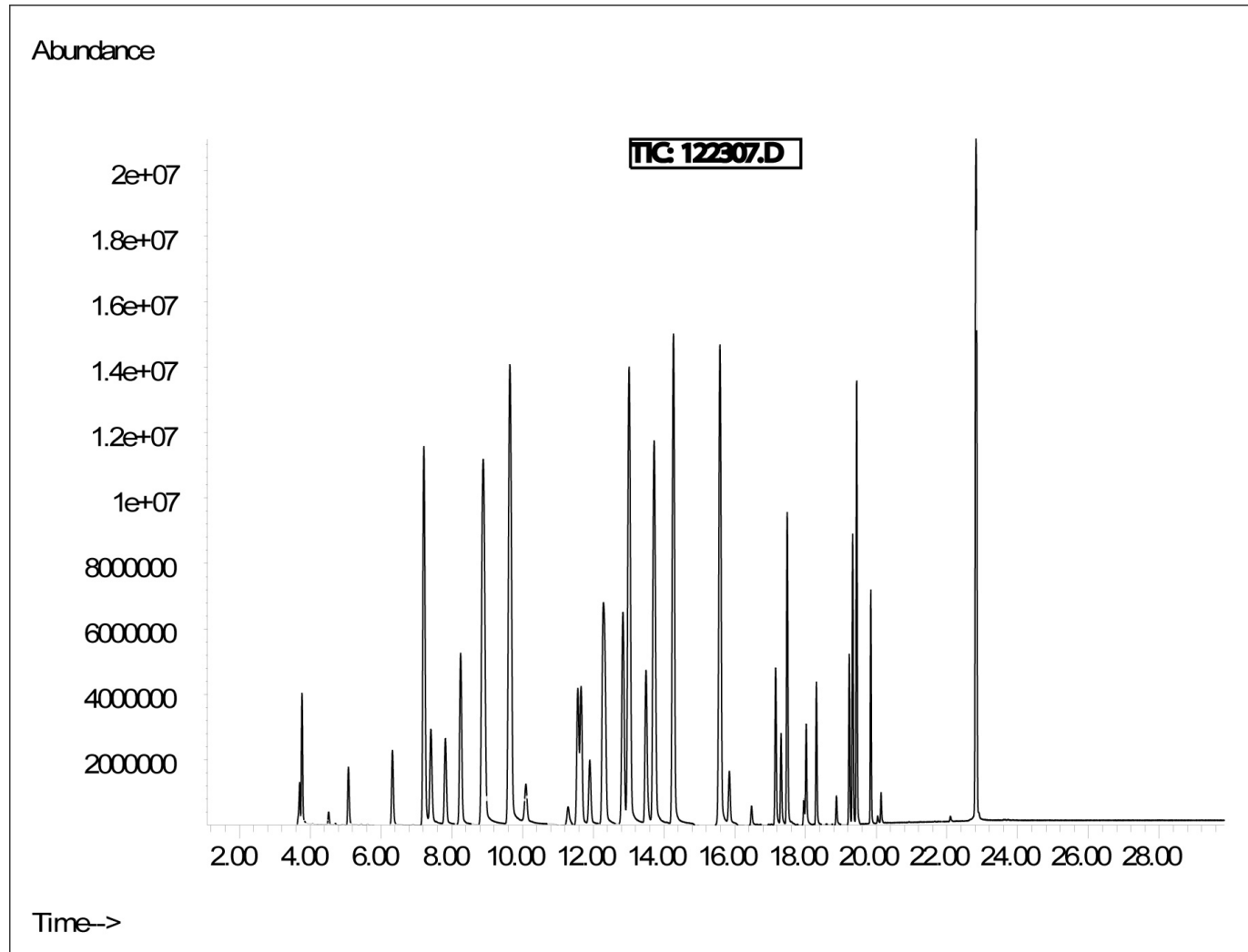
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Improve-Residual Solvent Analysis

Compounds	Class	r^2 Values	Curve range	MDL (ppm)	Concentration Limit (ppm)
Methanol	2	0.999	5ppm-500ppm	1.85	3000
Ethanol	3	1.000	2ppm-500ppm	0.46	5000
1,1-dichloroethene	1	0.995	2ppm-50ppm	0.28	8
Acetone	3	0.999	2ppm-200ppm	0.42	5000
2-propanol	3	1.000	2ppm-500ppm	0.38	5000
Acetonitrile	2	1.000	2ppm-500ppm	0.44	410
Dichloromethane	2	0.999	2ppm-500ppm	0.81	600
MTBE	3	0.996	2ppm-500ppm	0.85	5000
Hexane	2	0.996	2ppm-100ppm	0.72	290
1-propanol	3	1.000	2ppm-500ppm	0.86	5000
Nitromethane	2	1.000	2ppm-500ppm	0.65	50
cis 1,2-dichloroethene	2	1.000	2ppm-500ppm	0.73	1870
Ethyl Acetate	3	0.998	2ppm-500ppm	0.61	5000
2-butanol	3	1.000	2ppm-500ppm	0.74	5000
Tetrahydrofuran	3	0.995	10ppm-500ppm	0.21	5000
Chloroform	2	1.000	2ppm-500ppm	0.52	60
1,1,1-trichloroethane	1	0.999	2ppm-500ppm	0.75	1500
Cyclohexane	2	0.996	2ppm-200ppm	0.55	3880
Carbon Tetrachloride	1	0.997	2ppm-100ppm	0.33	4
1,2-dimethoxyethane	2	0.997	2ppm-500ppm	0.32	100
2-methoxyethanol	2	1.000	2ppm-500ppm	0.47	50
Benzene	1	0.999	2ppm-500ppm	0.38	2

Residual Solvents Continued

Compounds	Class	r² Values	Curve range	MDL (ppm)	Concentration Limit (ppm)
Isopropyl acetate	3	0.999	2ppm-200ppm	0.35	5000
1,2-dichloroethane	1	0.999	2ppm-500ppm	0.56	5
Heptane	3	0.996	2ppm-100ppm	0.34	5000
Methylcyclohexane	2	0.998	2ppm-200ppm	0.45	1180
1,4-dioxane	2	1.000	2ppm-500ppm	0.67	380
2-ethoxyethanol	2	0.996	2ppm-200ppm	1.11	160
MIBK	3	0.999	2ppm-500ppm	0.50	5000
Pyridine	2	0.998	2ppm-500ppm	1.47	200
Toluene	2	0.999	2ppm-200ppm	0.61	890
1-pentanol	3	0.996	10ppm-200ppm	1.34	5000
1,1,2-trichloroethene	2	0.999	2ppm-500ppm	0.72	80
2-hexanone	2	0.999	2ppm-500ppm	0.83	50
N,N-dimethylformamide	2	1.000	2ppm-500ppm	1.35	880
Chlorobenzene	2	1.000	2ppm-500ppm	0.84	360
Ethylbenzene	unlisted	0.997	2ppm-500ppm	0.66	unlisted
M&P-xylene	2	0.999	2ppm-200ppm	0.45	2170
O-xylene	2	0.999	2ppm-500ppm	0.56	2170
DMSO	3	0.995	10ppm-500ppm	0.46	5000
N,N-dimethylacetamide	2	1.000	2ppm-500ppm	0.76	1090
N-methylpyrolidone	2	1.000	10ppm-500ppm	1.83	530
1,2,3,4-tetrahydronaphthalene	2	1.000	10ppm-500ppm	1.89	100

500ppm Chromatogram

Dynamic Option Results

Compounds	r^2 Values	MDL (ppb)	Concentration Limit (ppm)
1,1-dichloroethene	0.999	0.37	8
1,1,1-trichloroethane	0.999	0.37	1500
Carbon Tetrachloride	0.998	0.29	4
Benzene	0.995	0.50	2
1,2-dichloroethane	0.996	0.49	5

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