APPLICATION NOTE: AN1906
TECHNOLOGY: P+T VOC
INDUSTRY: ENV

Automated Dilution of Samples Using US EPA Method 8260 on the Teledyne Tekmar Atomx XYZ and Thermo Scientific™ TRACE™ 1310 GC and ISQ™ 7000 MS with an Advanced Electron Ionization (AEI) Source

Amy Nutter, Applications Chemist; Teledyne Tekmar

Abstract

The Teledyne Tekmar Atomx XYZ purge and trap (P&T) system performed the automated dilution of high-level volatile organic compound (VOCs) water samples using US EPA Method 8260. Determination was performed by a Thermo Scientific TRACE 1310 Gas Chromatograph (GC) and ISQ 7000 Mass Spectrometer (MS) with Advanced Electron Ionization (AEI) Source. A working linear calibration curve for target compounds was created and accuracy and precision of the Atomx XYZ's automated dilution function was evaluated.

Introduction

The Atomx XYZ is Teledyne Tekmar's second-generation, multi-matrix P&T system and is based on the time-tested Atomx instrument platform. The concentrator's efficient trap cooling design reduces sample cycle time by as much as 14% over the previous model. Combined with its 84-position soil and water autosampler, the result is more samples tested per 12-hour period. An innovative moisture control system (MCS) improves water vapor removal by as much as 60%, reducing peak interference and increasing GC column lifespan. In addition to other refinements, the Atomx XYZ incorporates a precision-machined valve manifold block to reduce potential leak sources and ensure the system is reliable and robust.

Sample Preparation

A 50 ppm working calibration standard was prepared in methanol from the following Restek® standards: 8260B MegaMix®, 8260B Acetate, California Oxygenates, VOA (Ketones), 502.2 Calibration Mix, 2-Chloroethyl Vinyl Ether, and Hexachloroethane. In total, the standards contained 96 compounds.

A water calibration curve was prepared from 2 ppb to 200 ppb for all compounds. The relative response factor (RF) was calculated for each compound using one of four internal standards: Pentafluorobenzene, 1,4-Difluorobenzene, Chlorobenzene-d5, and 1,4-Dichlorobenzene-d4. Surrogate standards consisted of: Dibromofluoromethane, 1,2-Dichloroethane-d4, Toluene-d8, and Bromofluorobenzene. Internal and surrogate standards were prepared together in methanol from Restek standards at a concentration of 25 ppm, after which 5 µL was then mixed with each 5 mL sample for a resulting concentration of 25 ppb.

The Atomx XYZ performed six dilution ratios of a 200 ppb standard. Five diluted standards were created for each dilution ratio:

Dilution Ratio	Resulting Concentration
1:100	2 ppb
1:50	4 ppb
1:25	8 ppb
1:10	20 ppb
1:5	40 ppb
1:2	100 ppb

All calibration and diluted standards were analyzed with the Atomx XYZ conditions in Table I. GC/MS conditions are shown in Table II.

Experimental Instrument Conditions

Table I Teledyne Tekmar Atomx XYZ Water Method Conditions			
Standby	**Variable**	**Desorb**	**Variable**
Valve Oven Temp	140 ºC	Water Needle Rinse Volume	7.0 mL
Transfer Line Temp	140 ºC	Sweep Needle Time	0.25 min
Sample Mount Temp	90 ºC	Desorb Preheat Temp	245 ºC
Water Heater Temp	90 ºC	Desorb Time	1.00 min
Soil Valve Temp	100 ºC	Drain Flow	300 mL/min
Standby Flow	10 mL/min	Desorb Temp	250 ºC
Purge Ready Temp	40 ºC	Methanol Needle Rinse	Off
Purge	**Variable**	GC Start Signal	Begin Desorb
Sample Equilibrate Time	0.00 min	**Bake**	**Variable**
Presweep Time	0.25 min	Methanol Glass Rinse	Off
Prime Sample Fill Volume	3.0 mL	Number of Water Bake Rinses	1
Sample Volume	5.0 mL	Water Bake Rinse Volume	7.0 mL
Sweep Sample Time	0.25 min	Bake Rinse Sweep Time	0.25 min
Sweep Sample Flow	100 mL/min	Bake Rinse Sweep Flow	100 mL/min
Purge Time	11.00 min	Bake Rinse Drain Time	0.40 min
Purge Flow	40 mL/min	Bake Time	2.00 min
Purge Temp	20 ºC	Bake Flow	200 mL/min
MCS Purge Temp	20 ºC	Bake Temp	280 ºC
Dry Purge Time	2.00 min	MCS Bake Temp	180 ºC
Dry Purge Flow	100 mL/min	**Trap**	9
Dry Purge Temp	20 ºC	**Chiller Tray**	Off
		Purge Gas	Helium

Sales/Support: 800-874-2004 · **Main:** 513-229-7000
4736 Socialville Foster Rd., Mason, OH 45040
www.teledynetekmar.com

Table II Thermo Scientific TRACE 1310 GC and ISQ 7000 MS System Conditions	
Thermo Scientific TRACE 1310 GC Conditions	
Column	Rtx®-VMS, 20 m x 0.18 mm, 1µm Film, Helium – 0.8 mL/min
Oven Profile	35 ºC, 2 min, 12 ºC/min to 85 ºC, 20ºC/min to 225 ºC, 2 min Hold, Run Time 15.167 min
Inlet	200 ºC, 50:1 Split
Thermo Scientific ISQ 7000 MS Conditions	
Temp	Transfer Line 300 ºC; Ion Source 280 ºC
Scan	Range 35 *amu* to 260 *amu*, Solvent Delay 0.10 min, Normal Scanning
Current	Emission Current 25 µA, Gain 3.00E+005

Results

The relative standard deviation (%RSD) of the response factors (RF) for the calibration curve and precision (%RSD) and accuracy (%Recovery) calculations for the diluted standards are shown in Table III and Table IV. Figure 1 displays a chromatogram of an automated 1:2 dilution (100 ppb) standard, indicating excellent peak resolution with no water inference for all VOCs.

Table III US EPA Method 8260 Water Method Calibration and Automated Dilution Standard (1:100, 1:50 and 1:25) Data

Compound	Calibration			Dilutions					
				1:100		1:50		1:25	
	Ret. Time	%RSD (≤20%)	Avg. RF	Prec. (≤20% RSD)	Accy. (70-130%)	Prec. (≤20% RSD)	Accy. (70-130%)	Prec. (≤20% RSD)	Accy. (70-130%)
Dichlorodifluoromethane	1.39	10.8	9.37	1.59	128	1.52	125	4.94	109
Chloromethane	1.55	11.2	15.3	3.45	95	0.971	97	5.44	100
Vinyl Chloride	1.63	8.37	11.0	3.54	93	1.76	94	5.87	96
Bromomethane	1.91	10.4	22.6	2.66	87	2.12	92	7.75	97
Chloroethane	2.03	4.90	14.2	4.64	81	1.29	84	3.12	104
Trichlorofluoromethane	2.15	7.70	36.4	2.92	108	2.65	102	2.61	98
Diethyl Ether	2.44	6.98	25.1	4.44	81	1.87	93	3.76	93
1,1-Dichloroethene	2.54	9.57	82.6	7.15	116	1.69	97	6.14	94
Carbon Disulfide	2.54	10.4	79.0	7.15	121	1.71	101	4.39	97
1,1,2-Trichlorotrifluoroethane	2.57	7.57	23.3	2.10	126	2.35	118	4.36	100
Iodomethane[1]	2.63	0.997	0.663	4.42	92	8.71	99	7.68	95
Allyl Chloride	2.88	8.15	15.0	2.50	85	0.979	91	8.31	86
Methylene Chloride	2.96	8.86	52.0	3.30	79	1.50	88	4.70	87
Acetone	3.07	14.0	15.0	3.67	121	2.80	122	6.06	120
trans-1,2-Dichloroethene	3.08	10.3	13.4	4.53	93	1.05	91	8.23	84
1,1-Dichloroethane	3.08	7.96	39.8	3.89	101	1.94	95	8.65	84
Methyl Acetate	3.24	8.08	3.05	5.71	80	2.37	95	2.46	96
Acetonitrile	3.24	9.19	20.3	3.35	81	2.34	95	3.01	96
Methyl-tert-butyl Ether	3.24	6.90	41.4	3.15	83	1.63	97	3.30	97

Table III US EPA Method 8260 Water Method Calibration and Automated Dilution Standard (1:100, 1:50 and 1:25) Data

Compound	Calibration			Dilutions					
				1:100		1:50		1:25	
	Ret. Time	%RSD (≤20%)	Avg. RF	Prec. (≤20% RSD)	Accy. (70-130%)	Prec. (≤20% RSD)	Accy. (70-130%)	Prec. (≤20% RSD)	Accy. (70-130%)
tert-Butyl Alcohol	3.39	8.00	7.53	8.05	92	5.89	104	4.58	116
Chloroprene	3.52	5.24	25.8	3.51	88	1.65	89	9.45	93
Diisopropyl Ether	3.52	4.53	78.9	3.09	74	1.02	84	4.92	96
Vinyl Acetate	3.52	8.44	45.7	6.42	85	3.81	87	5.04	85
Acrylonitrile	3.61	10.3	6.30	4.93	114	3.62	123	9.57	109
Propionitrile	3.61	8.79	0.008	5.54	100	11.7	115	2.40	127
tert-Butyl Ethyl Ether	3.80	7.01	1.92	4.83	99	1.02	84	4.36	86
cis-1,2-Dichloroethene	3.95	9.68	0.515	3.62	88	2.11	93	6.47	90
2,2-Dichloropropane	4.04	9.09	20.9	3.73	80	1.15	85	9.40	78
Bromochloromethane	4.10	11.1	6.75	5.45	104	1.11	89	5.06	90
Chloroform	4.17	11.4	26.4	2.70	84	0.968	92	6.35	90
Carbon Tetrachloride	4.26	9.21	17.9	2.45	90	1.39	97	9.91	94
Dibromofluoromethane (SURR)	4.31	8.35	0.564	11.0	102	5.99	109	5.41	106
1,1,1-Trichloroethane	4.32	5.81	23.1	2.26	83	0.753	88	9.35	83
Methyl Acrylate	4.34	6.90	12.7	4.62	116	1.83	126	5.17	129
Ethyl Acetate	4.35	9.23	0.815	5.34	110	4.31	117	2.14	125
1,1-Dichloropropene	4.42	5.17	18.2	4.31	105	1.54	99	9.88	89
2-Butanone	4.50	6.73	11.4	11.6	104	6.20	122	3.60	128
Benzene	4.62	7.66	51.5	3.77	86	1.33	92	7.51	88
Methacrylonitrile	4.70	7.03	0.602	4.87	120	0.974	127	1.54	127
Pentafluorobenzene (IS)	4.71								
1,2-Dichlorobenzene-d4 (SURR)	4.71	1.97	0.138	2.87	100	4.45	100	3.70	101
1,2-Dichloroethane	4.79	7.55	1.04	4.44	83	1.16	93	3.49	95
tert-Amyl Methyl Ether	4.80	7.79	1.60	7.36	73	3.97	86	3.26	90
Isobutanol	4.80	8.90	27.5	1.97	79	2.33	89	4.05	86
Tetrahydrofuran	4.99	12.5	0.009	6.54	109	7.33	120	12.1	94
Isopropyl Acetate	5.10	6.12	1.81	4.47	107	1.67	120	3.28	115
Trichloroethylene	5.10	12.1	0.699	3.31	100	1.92	97	8.07	89
1,4-Difluorobenzene (IS)	5.15								
Dibromomethane	5.45	9.32	0.408	4.08	85	1.29	94	3.38	95
1,2-Dichloropropane	5.55	8.76	0.615	3.53	81	1.35	90	5.65	89
Bromodichloromethane	5.61	7.23	0.807	3.92	77	1.13	88	5.59	91
Methyl Methacrylate	5.82	5.67	0.341	3.59	98	1.89	115	2.77	116
Propyl Acetate	5.98	6.81	1.28	2.42	119	2.29	129	3.27	123
2-Chloroethyl Vinyl Ether	6.15	7.94	8.42	4.46	78	4.45	94	2.62	86
cis-1,3-Dichloropropene	6.18	7.40	0.754	7.72	85	1.48	81	4.32	82
Toluene-d8 (SURR)	6.34	1.70	1.75	1.14	103	1.67	103	1.46	102
Toluene	6.39	6.61	2.13	3.47	94	0.558	96	8.33	89
2-Nitropropane	6.61	9.69	0.329	15.4	111	5.42	98	2.79	113
Tetrachloroethene	6.71	13.1	1.15	1.16	128	0.474	121	7.26	103
trans-1,3-Dichloropropene	6.76	7.70	0.724	5.79	82	2.00	82	3.68	84

Sales/Support: 800-874-2004 · **Main:** 513-229-7000
4736 Socialville Foster Rd., Mason, OH 45040
www.teledynetekmar.com

Table III US EPA Method 8260 Water Method Calibration and Automated Dilution Standard (1:100, 1:50 and 1:25) Data

Compound	Calibration			Dilutions					
				1:100		1:50		1:25	
	Ret. Time	%RSD (≤20%)	Avg. RF	Prec. (≤20% RSD)	Accy. (70-130%)	Prec. (≤20% RSD)	Accy. (70-130%)	Prec. (≤20% RSD)	Accy. (70-130%)
4-Methyl-2-Pentanone	6.80	8.17	0.994	3.31	118	3.97	125	1.26	125
1,1,2-Trichloroethane	6.89	5.24	0.456	3.56	82	1.39	94	4.03	95
Ethyl Methacrylate	6.97	9.32	0.658	4.04	77	0.287	91	3.25	94
Dibromochloromethane	7.03	8.58	0.548	5.00	103	0.935	85	4.87	88
1,3-Dichloropropane	7.12	6.57	0.854	3.49	82	0.552	90	4.58	92
1,2-Dibromoethane	7.22	6.36	0.521	4.84	87	1.08	96	3.65	97
Butyl Acetate	7.44	9.15	1.49	3.85	97	1.60	108	2.91	108
2-Hexanone	7.51	6.63	0.671	5.68	117	4.16	121	4.39	130
Chlorobenzene-d5 (IS)	7.65								
Chlorobenzene	7.67	6.17	1.39	4.52	96	0.900	96	6.53	90
Ethylbenzene	7.70	3.31	2.41	4.50	95	1.92	92	7.84	86
1,1,1,2-Tetrachloroethane	7.73	6.08	12.4	2.35	74	1.58	83	4.96	84
m-,p-Xylene	7.83	8.23	0.750	5.08	86	1.92	84	6.69	80
o-Xylene	8.17	5.89	0.709	3.54	81	2.37	83	5.72	80
Bromoform	8.22	6.31	0.352	12.2	84	1.26	84	2.56	89
Styrene	8.22	9.39	1.15	16.0	86	4.97	74	4.33	76
Isopropylbenzene	8.43	5.52	1.79	3.96	90	1.46	87	7.71	82
Amyl Acetate	8.60	10.6	1.31	6.63	79	1.53	89	3.66	91
4-Bromofluorobenzene (SURR)	8.65	3.66	0.926	2.69	102	3.58	100	2.08	102
1,2,3-Trichloropropane	8.72	6.86	0.313	5.11	94	5.03	76	7.59	83
Bromobenzene	8.72	8.44	1.65	7.49	91	10.1	88	7.01	87
n-Propylbenzene	8.76	6.71	3.70	4.12	105	5.40	93	7.90	87
1,1,2,2-Tetrachloroethane	8.82	11.1	0.589	4.25	90	5.59	104	6.20	112
2-Chlorotoluene	8.87	8.24	2.13	4.15	98	5.24	92	6.52	90
1,3,5-Trimethylbenzene	8.93	7.05	2.65	4.65	95	6.29	88	8.35	86
cis-1,4-Dichloro-2-Butene	8.97	16.6	0.140	6.69	92	6.19	102	9.66	115
4-Chlorotoluene	9.01	7.53	2.34	4.89	103	5.90	93	6.12	90
tert-Butylbenzene	9.17	5.99	2.17	3.57	95	6.19	88	8.14	84
1,2,4-Trimethylbenzene	9.23	7.76	2.80	3.94	88	6.19	84	6.97	83
sec-Butylbenzene	9.32	7.77	3.15	3.16	112	6.30	98	7.96	90
p-Isopropyltoluene	9.44	7.88	2.44	4.03	112	5.70	98	7.43	91
1,3-Dichlorobenzene	9.47	10.4	1.97	4.23	100	5.54	89	5.90	84
1,4-Dichlorobenzene-d4 (IS)	9.54								
1,4-Dichlorobenzene	9.55	8.53	1.88	4.77	106	6.32	91	6.15	87
n-Butylbenzene	9.77	7.95	2.86	3.68	128	4.98	103	9.18	90
Pentachloroethane	9.85	8.53	0.008	17.2	112	10.8	116	7.16	104
Hexachloroethane	9.85	10.2	0.360	4.19	94	6.70	91	8.04	89
1,2-Dichlorobenzene	9.88	8.00	1.88	4.40	91	5.80	87	5.95	86
1,2-Dibromo-3-Chloropropane	10.51	7.92	0.168	4.26	108	7.50	126	5.35	126
Hexachlorobutadiene	10.92	14.1	0.001	18.5	111	9.95	119	4.00	123

Sales/Support: 800-874-2004 · **Main:** 513-229-7000
4736 Socialville Foster Rd., Mason, OH 45040
www.teledynetekmar.com

Table III US EPA Method 8260 Water Method Calibration and Automated Dilution Standard (1:100, 1:50 and 1:25) Data

Compound	Calibration			Dilutions					
				1:100		1:50		1:25	
	Ret. Time	%RSD (≤20%)	Avg. RF	Prec. (≤20% RSD)	Accy. (70-130%)	Prec. (≤20% RSD)	Accy. (70-130%)	Prec. (≤20% RSD)	Accy. (70-130%)
Nitrobenzene	10.97	9.76	0.035	4.14	78	14.0	97	3.27	120
1,2,4-Trichlorobenzene	11.05	7.16	1.09	3.92	105	6.59	92	7.84	87
Naphthalene	11.31	9.41	2.21	12.2	79	7.01	114	7.90	91
1,2,3-Trichlorobenzene	11.45	8.28	1.02	4.91	100	5.91	93	8.37	92

1. Compound was linear regressed.

Table IV US EPA Method 8260 Water Method Automated Dilution Standard (1:10, 1:5 and 1:2) Data

Compound	Dilutions					
	1:10		1:5		1:2	
	Precision (≤20% RSD)	Accuracy (70-130%)	Precision (≤20% RSD)	Accuracy (70-130%)	Precision (≤20% RSD)	Accuracy (70-130%)
Dichlorodifluoromethane	6.18	98	6.54	93	6.37	105
Chloromethane	3.15	92	3.98	99	0.948	77
Vinyl Chloride	7.93	94	4.89	97	0.964	77
Bromomethane	6.11	95	4.56	96	7.31	95
Chloroethane	3.58	103	7.39	99	4.38	109
Trichlorofluoromethane	11.1	92	5.54	104	1.89	75
Diethyl Ether	1.24	94	13.3	93	1.86	83
1,1-Dichloroethene	7.97	108	2.27	99	1.76	95
Carbon Disulfide	5.67	103	6.93	98	1.47	76
1,1,2-Trichlorotrifluoroethane	7.61	92	11.9	91	5.54	96
Iodomethane[1]	7.33	90	10.5	112	6.67	113
Allyl Chloride	1.68	88	16.1	91	1.93	83
Methylene Chloride	0.656	87	15.0	88	1.51	80
Acetone	1.83	127	10.6	110	3.03	80
trans-1,2-Dichloroethene	1.70	82	15.3	91	1.98	79
1,1-Dichloroethane	9.46	85	13.8	88	1.86	76
Methyl Acetate	1.20	99	14.1	102	1.63	95
Acetonitrile	0.693	99	14.8	101	0.727	94
Methyl-tert-butyl Ether	0.748	101	14.8	105	1.79	101
tert-Butyl Alcohol	3.40	123	1.35	128	1.57	112
Chloroprene	3.94	88	19.2	100	1.41	104
Diisopropyl Ether	1.16	93	16.4	102	2.03	106
Vinyl Acetate	0.900	86	15.8	91	1.10	91
Acrylonitrile	1.96	121	6.88	115	1.56	99
Propionitrile	3.21	127	12.5	114	2.65	108
tert-Butyl Ethyl Ether	3.36	92	14.8	100	1.66	100
cis-1,2-Dichloroethene	2.65	91	16.3	97	1.57	94

Table IV US EPA Method 8260 Water Method Automated Dilution Standard (1:10, 1:5 and 1:2) Data						
Compound	Dilutions					
	1:10		1:5		1:2	
	Precision (≤20% RSD)	Accuracy (70-130%)	Precision (≤20% RSD)	Accuracy (70-130%)	Precision (≤20% RSD)	Accuracy (70-130%)
2,2-Dichloropropane	0.527	104	7.26	103	2.33	74
Bromochloromethane	0.527	92	15.5	95	1.10	90
Chloroform	1.02	91	16.7	96	0.754	91
Carbon Tetrachloride	2.95	97	17.4	105	1.64	100
Dibromofluoromethane (SURR)	7.39	113	6.08	103	4.65	101
1,1,1-Trichloroethane	2.11	86	17.6	92	0.750	88
Methyl Acrylate	1.39	126	9.52	118	1.33	112
Ethyl Acetate	7.29	122	6.40	116	2.33	101
1,1-Dichloropropene	3.73	89	18.2	98	1.15	98
2-Butanone	2.19	127	3.72	123	1.68	105
Benzene	1.40	90	17.4	97	1.08	97
Methacrylonitrile	3.95	124	10.8	118	1.15	105
Pentafluorobenzene (IS)						
1,2-Dichlorobenzene-d4 (SURR)	3.30	102	2.06	99	2.66	99
1,2-Dichloroethane	3.40	95	14.8	100	1.26	97
tert-Amyl Methyl Ether	2.34	96	11.5	104	2.06	107
Isobutanol	0.989	90	15.7	97	1.08	97
Tetrahydrofuran	11.4	108	15.3	115	9.38	94
Isopropyl Acetate	3.10	110	12.2	109	1.02	104
Trichloroethylene	4.57	87	16.8	90	1.70	87
1,4-Difluorobenzene (IS)						
Dibromomethane	3.50	96	14.3	99	1.37	94
1,2-Dichloropropane	2.84	91	15.3	98	1.10	94
Bromodichloromethane	2.90	94	14.4	101	1.76	96
Methyl Methacrylate	3.28	113	10.2	115	0.864	108
Propyl Acetate	4.56	119	9.48	113	1.38	104
2-Chloroethyl Vinyl Ether	1.35	99	12.4	105	1.29	111
cis-1,3-Dichloropropene	3.70	88	15.6	98	1.42	106
Toluene-d8 (SURR)	1.84	100	1.48	99	2.10	99
Toluene	3.19	90	17.0	99	1.89	100
2-Nitropropane	1.69	92	16.8	89	1.05	83
Tetrachloroethene	2.43	94	15.3	98	2.04	96
trans-1,3-Dichloropropene	2.84	89	15.6	99	1.75	105
4-Methyl-2-Pentanone	3.37	117	10.7	111	1.74	102
1,1,2-Trichloroethane	2.82	97	13.8	101	1.89	96
Ethyl Methacrylate	3.27	98	10.2	106	1.87	111
Dibromochloromethane	3.01	95	14.6	102	1.93	101
1,3-Dichloropropane	2.85	93	13.7	99	1.48	97
1,2-Dibromoethane	2.55	97	14.2	101	1.20	96
Butyl Acetate	3.70	105	13.1	108	1.54	107
2-Hexanone	3.63	129	8.41	119	1.86	109

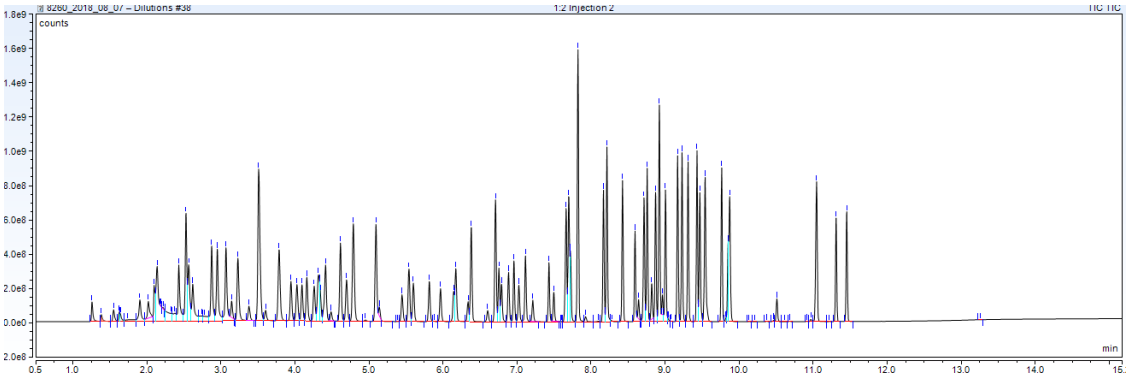
Sales/Support: 800-874-2004 · **Main:** 513-229-7000
4736 Socialville Foster Rd., Mason, OH 45040
www.teledynetekmar.com

Table IV US EPA Method 8260 Water Method Automated Dilution Standard (1:10, 1:5 and 1:2) Data						
Compound	Dilutions					
	1:10		1:5		1:2	
	Precision (≤20% RSD)	Accuracy (70-130%)	Precision (≤20% RSD)	Accuracy (70-130%)	Precision (≤20% RSD)	Accuracy (70-130%)
Chlorobenzene-d5 (IS)						
Chlorobenzene	2.52	91	16.4	98	1.37	101
Ethylbenzene	2.87	89	18.5	101	1.36	104
1,1,1,2-Tetrachloroethane	0.720	89	16.6	97	1.75	98
m-,p-Xylene	4.54	85	17.8	98	2.68	104
o-Xylene	4.86	85	18.4	98	2.56	103
Bromoform	3.64	97	7.80	102	1.94	112
Styrene	5.63	84	18.4	99	3.08	110
Isopropylbenzene	5.46	86	16.4	99	2.27	105
Amyl Acetate	3.39	100	11.7	107	2.45	116
4-Bromofluorobenzene (SURR)	4.19	104	2.91	101	0.343	103
1,2,3-Trichloropropane	6.85	105	15.1	102	2.58	102
Bromobenzene	11.2	89	8.08	92	2.58	86
n-Propylbenzene	8.61	91	16.8	96	1.84	98
1,1,2,2-Tetrachloroethane	5.69	119	6.68	113	4.16	111
2-Chlorotoluene	7.54	95	16.3	99	2.48	102
1,3,5-Trimethylbenzene	9.10	94	17.2	101	2.28	106
cis-1,4-Dichloro-2-Butene	7.52	116	13.7	109	2.71	106
4-Chlorotoluene	8.23	95	16.5	99	2.85	103
tert-Butylbenzene	9.66	89	17.7	94	2.62	98
1,2,4-Trimethylbenzene	8.51	91	16.9	97	2.05	100
sec-Butylbenzene	9.61	95	18.0	99	1.60	101
p-Isopropyltoluene	10.2	96	17.3	101	2.23	105
1,3-Dichlorobenzene	9.22	85	14.8	83	2.09	85
1,4-Dichlorobenzene-d4 (IS)						
1,4-Dichlorobenzene	8.15	89	14.6	87	3.62	90
n-Butylbenzene	9.80	91	16.9	94	2.01	97
Pentachloroethane	8.95	107	15.3	104	2.78	101
Hexachloroethane	8.71	99	15.4	103	2.69	110
1,2-Dichlorobenzene	7.86	89	13.8	85	3.09	86
1,2-Dibromo-3-Chloropropane	1.97	129	3.32	125	2.39	117
Hexachlorobutadiene	4.92	120	10.4	110	4.85	102
Nitrobenzene	2.41	128	6.27	119	4.23	110
1,2,4-Trichlorobenzene	6.73	92	14.0	94	2.67	102
Naphthalene	4.79	108	11.9	108	3.35	103
1,2,3-Trichlorobenzene	7.03	101	11.7	100	2.65	100

1. Compound was linear regressed.

Sales/Support: 800-874-2004 · **Main:** 513-229-7000
4736 Socialville Foster Rd., Mason, OH 45040
www.teledynetekmar.com

Figure 1 Total Ion Chromatogram of a Water Method Automated 1:2 Dilution (100 ppb) VOC Standard Indicating Consistent Peak Shapes for all Compounds with Minimal Water Interference.



Conclusion

This study demonstrates the capability of the Teledyne Tekmar Atomx XYZ P&T system to use automated dilution to process VOCs in water samples, following US EPA Method 8260, with detection by a Thermo Scientific TRACE 1310 GC and ISQ 7000™ MS with an AEI Source. The %RSD of the calibration curve passed all method requirements. Furthermore, accuracy and precision for the five standards, in various levels of dilution, showed no interference from excessive water. Utilizing the automated dilution feature for high-level samples can save time and labor by expediting the analytical process and increasing productivity in the laboratory. By making additional, appropriate changes to the GC oven temperature program, the GC/MS cycle time may also be reduced, increasing laboratory throughput in a 12-hour period.

References

1. *Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*; US EPA, Office of Solid Waste, SW-846 Method 8260B, Revision 2, December 1996. [Online] https://19january2017snapshot.epa.gov/sites/production/files/2015-12/documents/8260b.pdf (accessed February 25, 2019).
2. *Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*; US EPA, Office of Solid Waste, SW-846 Method 8260C, Revision 3, August 2006. [Online] https://www.epa.gov/sites/production/files/2015-07/documents/epa-8260c.pdf (accessed February 25, 2019).