APPLICATION NOTE: AN1803
TECHNOLOGY: P+T VOC
INDUSTRY: ENV

US EPA Method 8260 with the Atomx XYZ and the Thermo Scientific™ TRACE™ 1310 GC and ISQ™ MS

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Abstract

US EPA Method 8260, in conjunction with Methods 5030 and 5035, was used to determine the concentration of volatile organic compounds (VOCs) in water and soil matrices. The Teledyne Tekmar Atomx XYZ purge and trap (P&T) system along with a Thermo Scientific™ TRACE™ 1310 Gas Chromatograph (GC) and ISQ™ Single Quadrupole Mass Spectrometer (MS) was used to create a working linear calibration curve and method detection limits (MDLs) for target compounds.

Introduction

The Atomx XYZ is Teledyne Tekmar's most advanced 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%, thereby reducing peak interference and increasing GC column life span. 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 both reliable and robust.

Sample Preparation

Calibration working standards in concentrations of 25 ppm and 50 ppm were prepared in methanol from Restek® standards: 8260B MegaMix®, 8260B Acetate, California Oxygenates, VOA (Ketones), 502.2 Calibration Mix, and 2-Chloroethyl Vinyl Ether. In total, the standards contained 96 compounds.

The water calibration curve was prepared from 0.5 ppb to 200 ppb for all compounds, while the soil calibration curve was prepared from 1 ppb to 200 ppb. The 25 ppm calibration working standard was diluted to create 0.5, 1.0, 2.0, and 5.0 ppb concentrations and the 50 ppm calibration working standard was diluted to create 10, 20, 50, 100, and 200 ppb concentrations. The relative response factor (RF) was calculated for each compound using one of the 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 4-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.

Seven 0.5 ppb standards for both the water and soil methods were prepared for MDL, accuracy, and precision calculations. All calibration and MDL samples were analyzed with the Atomx XYZ conditions in Table I (water method) and Table II (soil method) and the GC/MS conditions in Table III.

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Experimental Instrument Conditions

Table I Teledyne Tekmar Atomx XYZ Water Method Conditions			
Purge	**Variable**	**Desorb**	**Variable**
Valve Oven Temp	140 ºC	Methanol Needle Rinse	Off
Transfer Line Temp	140 ºC	Methanol Needle Rinse Volume	0.00 mL
Sample Mount Temp	90 ºC	Water Needle Rinse Volume	7.00 mL
Water Heater Temp	90 ºC	Sweep Needle Time	0.25 min
Sample Vial Temp	20 ºC	Desorb Preheat Temp	245 ºC
Soil Valve Temp	100 ºC	GC Start Signal	Begin Desorb
Standby Flow	10 mL/min	Desorb Time	2.00 min
Condensate Ready Temp	45 ºC	Drain Flow	300 mL/min
Purge Ready Temp	40 ºC	Desorb Temp	250 ºC
Purge	**Variable**	**Bake**	**Variable**
Sample Equilibrate Time	0.00 min	Methanol Glass Rinse	Off
Pre-sweep Time	0.25 min	Number of Methanol Glass Rinses	0
Prime Sample Fill Volume	3.00 mL	Methanol Glass Rinse Volume	0.00 mL
Sample Volume	5.00 mL	Water Bake Rinses	1
Sweep Sample Time	0.25 min	Water Bake Rinse Volume	7.00 mL
Sweep Sample Flow	100 mL/min	Bake Rinse Sweep Time	0.25 min
Sparge Vessel Heater	Off	Bake Rinse Sweep Flow	100 mL/min
Sparge Vessel Temp	20 ºC	Bake Rinse Drain Time	0.40 min
Pre-purge Time	0.00 min	Bake Time	2.00 min
Pre-purge Flow	0 mL/min	Bake Flow	200 mL/min
Purge Time	11.00 min	Bake Temp	260 ºC
Purge Flow	40 mL/min	Condensate Bake Temp	200 ºC
Purge Temp	20 ºC		
Condensate Purge Temp	20 ºC		
Dry Purge Time	0.00 min	**Trap**	#9
Dry Purge Flow	0 mL/min	**Purge Gas**	Helium
Dry Purge Temp	20 ºC		

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Table II Teledyne Tekmar Atomx XYZ Soil Method Conditions			
Purge	**Variable**	**Desorb**	**Variable**
Valve Oven Temp	140 ºC	Methanol Needle Rinse	Off
Transfer Line Temp	140 ºC	Methanol Needle Rinse Volume	0.00 mL
Sample Mount Temp	90 ºC	Water Needle Rinse Volume	7.00 mL
Water Heater Temp	90 ºC	Sweep Needle Time	0.25 min
Sample Vial Temp	40 ºC	Desorb Preheat Temp	245 ºC
Soil Valve Temp	100 ºC	GC Start Signal	Begin Desorb
Standby Flow	10 mL/min	Desorb Time	2.00 min
Condensate Ready Temp	45 ºC	Drain Flow	300 mL/min
Purge Ready Temp	40 ºC	Desorb Temp	250 ºC
Purge	**Variable**	**Bake**	**Variable**
Pre-purge Time	0.00 min	Bake Time	2.00 min
Pre-Purge Flow	0 mL/min	Bake Flow	400 mL/min
Pre-heat Mix Speed	Slow	Bake Temp	280 ºC
Sample Pre-heat Time	0.00 min	Condensate Bake Temp	200 ºC
Pre-sweep Time	0.25 min		
Water Volume	10.00 mL		
Sweep Water Time	0.25 min	**Trap**	#9
Sweep Water Flow	100 mL/min	**Purge Gas**	Helium
Sparge Vessel Heater	Off		
Purge Mix Speed	Medium		
Purge Time	11.00 min		
Purge Flow	40 mL/min		
Purge Temp	20 ºC		
Condensate Purge Temp	20 ºC		
Dry Purge Time	0.00 min		
Dry Purge Flow	0 mL/min		
Dry Purge Temp	20 ºC		

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Table III Thermo Scientific TRACE 1310 GC and ISQ MS System Conditions	
Thermo Scientific TRACE 1310 GC Conditions	
Column	Rtx® VMS, 20 m x 0.18 mm, 1µm Film, Helium – 1.0 mL/min
Oven Profile	35 ºC, 3 min, 14ºC/min to 100 ºC, 25ºC/min to 210 ºC, 2 min Hold, Run Time 14.00 min
Inlet	200 ºC, 60:1 Split, Helium Saver 20.0 mL/min after 2 min
Thermo Scientific ISQ MS Conditions	
Temp	Transfer Line 230 ºC; Ion Source 280 ºC
Scan	Range 35 *amu* to 260 *amu*, Solvent Delay 0.10 min, Normal Scanning
Current	Emission Current 20 µA, Gain 3.00E+005

Results

The relative standard deviation (%RSD) of the RFs for the calibration curve, MDL, accuracy, and precision data are shown in Table IV (water) and Table V (soil). Figure 1 (water) and Figure 2 (soil) display a 50 ppb standard, indicating excellent peak resolution with no water inference for all VOCs.

Table IV US EPA Method 8260 Water Calibration, Accuracy, and Precision Data

Compound	Retention Time	Calibration			Accuracy and Precision (n=7, 0.5 ppb)[1]		
		Linearity RF (≤20% RSD)	MDL (ppb)	Average RF	Average Concentration (ppb)	Accuracy (70-130%)	Precision (≤20% RSD)
Dichlorodifluoromethane	1.24	13.0	0.09	0.956	0.53	105	5.6
Chloromethane	1.39	13.7	0.10	2.467	0.56	112	5.6
Vinyl Chloride	1.46	7.5	0.14	1.507	0.52	105	8.7
Bromomethane	1.73	13.5	0.21	0.435	0.56	113	11.8
Chloroethane	1.84	14.7	0.15	0.368	0.55	110	8.5
Trichlorofluoromethane	1.96	7.3	0.07	0.582	0.49	99	4.8
Diethyl Ether	2.26	4.7	0.15	0.354	0.52	104	9.3
Carbon Disulfide	2.38	10.1	0.08	1.680	0.50	100	4.8
trans-1,2-Dichloroethene	2.38	9.9	0.13	0.394	0.54	109	7.9
1,1,2-Trichlorotrifluoroethane	2.43	4.9	0.14	0.337	0.49	97	9.2
Iodomethane	2.48	16.2	0.08	0.506	0.46	93	5.4
Acetonitrile	2.78	4.7	0.14	1.753	0.55	110	8.4
Allyl Chloride	2.78	5.0	0.12	0.278	0.52	103	7.1
Methylene Chloride	2.87	6.8	0.10	0.432	0.58	117	5.5
Acetone	2.95	7.9	0.10	0.093	0.63	127	5.2
1,1-Dichloroethene	3.02	7.0	0.10	0.449	0.52	104	6.3
Methyl Acetate	3.08	4.9	0.06	1.495	0.53	106	3.6
Methyl-tert-butyl Ether (MTBE)	3.17	5.3	0.09	2.727	0.49	97	6.0
tert-Butyl Alcohol (TBA)	3.33	11.1	0.08	0.157	0.50	101	5.0
Diisopropyl Ether	3.56	5.8	0.06	4.580	0.48	96	3.9
Vinyl Acetate	3.56	5.9	0.07	2.512	0.49	98	4.8

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Table IV US EPA Method 8260 Water Calibration, Accuracy, and Precision Data							
Compound	Retention Time	Calibration			Accuracy and Precision (n=7, 0.5 ppb)[1]		
		Linearity RF (≤20% RSD)	MDL (ppb)	Average RF	Average Concentration (ppb)	Accuracy (70-130%)	Precision (≤20% RSD)
Chloroprene	3.59	7.1	0.07	1.950	0.49	98	4.7
1,1-Dichloroethane	3.61	7.1	0.06	2.475	0.46	92	4.3
Acrylonitrile	3.68	7.1	0.08	0.663	0.53	106	4.5
Propionitrile	3.68	14.4	0.08	0.030	0.55	110	4.7
Ethyl-tert-butyl- Ether (ETBE)	3.90	7.5	0.06	4.089	0.43	87	4.4
cis-1,2-Dichloroethene	4.11	7.2	0.07	0.642	0.42	83	5.5
2,2-Dichloropropane	4.21	5.0	0.07	1.172	0.46	93	5.0
Bromochloromethane	4.29	6.1	0.13	0.318	0.50	99	8.5
Chloroform	4.38	6.2	0.10	1.367	0.51	101	6.0
Carbon Tetrachloride	4.47	7.2	0.13	0.563	0.52	103	7.9
Tetrahydrofuran	4.52	16.3	0.09	0.891	0.51	103	5.7
1,1,1-Trichloroethane	4.54	7.6	0.19	0.834	0.45	91	13.5
Dibromofluoromethane (SURR)	4.54	5.5		0.504	27.0	108	3.3
Methyl Acrylate	4.54	4.8	0.08	0.765	0.50	101	5.4
Ethyl Acetate	4.55	13.7	0.14	0.030	0.48	97	9.3
1,1-Dichloropropene	4.65	10.1	0.17	0.652	0.5	116	9.6
2-Butanone (MEK)	4.68	12.1	0.19	0.062	0.56	112	11.0
Benzene	4.88	4.2	0.08	3.751	0.45	90	5.4
Methacrylonitrile	4.95	10.6	0.10	0.304	0.49	99	6.4
1,2-Dichloroethane-d4 (SURR)	5.00	1.8		1.350	31.0	124	1.8
Pentafluorobenzene (IS)	5.01						
tert-Amyl Methyl Ether (TAME)	5.03	5.3	0.09	1.489	0.50	100	5.9
1,2-Dichloroethane	5.07	6.3	0.09	1.060	0.57	114	5.1
1.4-Dioxane	5.37	17.5	0.22	0.003	0.56	112	12.5
Isopropyl Acetate	5.38	8.2	0.09	1.780	0.57	115	5.1
Trichloroethylene	5.41	4.9	0.05	0.356	0.55	110	2.9
1,4-Diflourobenzene (IS)	5.47						
Dibromomethane	5.78	7.5	0.09	0.247	0.52	104	5.6
1,2-Dichloropropane	5.87	8.2	0.10	0.776	0.53	105	6.0
Bromodichloromethane	5.95	7.2	0.13	0.564	0.54	108	7.8
Ethyl Methacrylate	6.15	7.5	0.06	0.439	0.47	94	4.1
Propyl Acetate	6.29	8.9	0.06	1.435	0.55	110	3.5
2-Chloroethyl Vinyl Ether	6.50	12.4	0.19	0.511	0.48	97	12.4
cis-1,3-Dichloropropene	6.53	5.5	0.12	0.959	0.50	100	7.6
Toluene-d8 (SURR)	6.69	7.5		1.215	26.3	105	2.9
Toluene	6.73	6.0	0.12	0.891	0.49	99	7.5
Tetrachloroethene	7.07	13.9	0.19	0.341	0.53	107	11.3
4-Methyl-2-Pentanone	7.13	14.5	0.15	0.022	0.54	107	9.1
trans-1,3-Dichloropropene	7.13	4.5	0.10	0.861	0.48	96	6.7
1,1,2-Trichloroethane	7.27	6.8	0.13	0.423	0.52	103	7.9
Methyl Methacrylate	7.33	18.1	0.10	0.760	0.47	94	6.7
Dibromochloromethane	7.41	8.2	0.09	0.395	0.51	102	5.9

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Table IV US EPA Method 8260 Water Calibration, Accuracy, and Precision Data							
Compound	Retention Time	Calibration			Accuracy and Precision (n=7, 0.5 ppb)[1]		
		Linearity RF (≤20% RSD)	MDL (ppb)	Average RF	Average Concentration (ppb)	Accuracy (70-130%)	Precision (≤20% RSD)
1,3-Dichloropropane	7.51	6.9	0.09	0.951	0.53	105	5.3
1,2-Dibromoethane	7.61	6.1	0.15	0.332	0.50	101	9.5
2-Nitropropane	7.82	16.4	0.09	1.531	0.52	104	5.5
Butyl Acetate	7.84	13.5	0.08	1.580	0.51	103	5.0
2-Hexanone	7.90	7.8	0.09	0.354	0.54	107	5.6
Chlorobenzene-d5 (IS)	8.08						
Chlorobenzene	8.10	4.7	0.14	0.907	0.54	109	8.0
Ethylbenzene	8.14	4.7	0.12	1.651	0.50	100	7.4
1,1,1,2-Tetrachloroethane	8.16	10.5	0.17	0.621	0.55	110	9.6
m-,p-Xylene	8.27	10.7	0.42	0.532	1.01	101	13.1
o-Xylene	8.62	9.7	0.14	0.518	0.48	96	9.5
Bromoform	8.66	11.8	0.27	0.204	0.55	109	15.6
Styrene	8.66	11.0	0.15	0.886	0.46	92	10.6
Isopropylbenzene	8.87	14.7	0.13	1.277	0.45	90	9.0
Amyl Acetate	9.02	17.8	0.11	1.875	0.48	97	7.3
4-Bromofluorobenzene (Surr)	9.07	8.3		0.584	25.5	102	4.3
1,2,3-Trichloropropane	9.14	13.2	0.08	0.612	0.54	109	4.5
Bromobenzene	9.14	9.4	0.13	2.508	0.57	113	7.5
n-Propylbenzene	9.19	5.6	0.18	3.665	0.49	99	11.5
1,1,2,2-Tetrachloroethane	9.25	14.0	0.05	0.701	0.48	97	3.1
2-Chlorotoluene	9.29	8.3	0.12	2.457	0.49	98	8.1
1,3,5-Trimethylbenzene	9.35	8.6	0.17	2.370	0.45	90	11.8
cis-1,4-Dichloro-2-Butene	9.38	9.1	0.11	0.687	0.48	96	7.5
trans-1,4-dichloro-2-butene	9.38	9.1	0.09	0.611	0.50	100	5.5
4-Chlorotoluene	9.42	4.6	0.20	2.444	0.51	102	12.3
tert-Butylbenzene	9.57	11.1	0.06	1.976	0.47	94	4.2
Pentachloroethane	9.59	12.8	0.13	0.092	0.48	96	8.9
1,2,4-Trimethylbenzene	9.63	9.7	0.24	2.472	0.44	87	17.2
sec-Butylbenzene	9.70	8.5	0.14	2.844	0.47	94	9.8
p-Isopropyltoluene	9.81	11.9	0.16	2.551	0.46	91	11.3
1,3-Dichlorobenzene	9.84	6.1	0.08	1.510	0.56	111	4.5
1,4-Dichlorobenzene-d4 (IS)	9.89						
1,4-Dichlorobenzene	9.90	7.4	0.13	1.534	0.59	118	6.9
n-Butylbenzene	10.11	8.2	0.10	3.178	0.49	97	6.4
1,2-Dichlorobenzene	10.20	4.6	0.17	1.489	0.55	110	10.0
1,2-Dibromo-3-Chloropropane	10.76	5.9	0.09	0.409	0.55	109	5.1
Nitrobenzene	11.14	13.2	0.15	0.040	0.60	120	7.8
Hexachlorobutadiene	11.20	13.5	0.30	0.364	0.53	106	17.8
1,2,4-Trichlorobenzene	11.22	11.2	0.15	0.973	0.59	118	8.2
Naphthalene	11.43	6.4	0.18	4.033	0.47	93	12.0
1,2,3-Trichlorobenzene	11.55	13.0	0.20	1.069	0.55	111	11.3

1. Data from seven 0.5 ppb samples.

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Table V US EPA Method 8260 Soil Calibration, Accuracy, and Precision Data

Compound	Retention Time	Calibration			Accuracy and Precision (n=7, 0.5 ppb)[1]		
		Linearity RF (%RSD)	MDL (ppb)	Average RF	Average Concentration (ppb)	Accuracy (%)	Precision (%RSD)
Dichlorodifluoromethane	1.24	9.4	0.04	1.048	0.59	118	2.3
Chloromethane	1.39	9.7	0.08	2.881	0.59	118	4.5
Vinyl Chloride	1.46	6.8	0.13	0.487	0.53	106	7.9
Bromomethane	1.73	9.8	0.09	0.487	0.59	118	4.9
Chloroethane	1.84	7.3	0.06	0.474	0.59	119	3.0
Trichlorofluoromethane	1.96	6.4	0.10	0.610	0.50	101	6.0
Diethyl Ether	2.26	4.7	0.13	0.414	0.53	106	7.9
Carbon Disulfide	2.38	4.6	0.07	2.309	0.56	112	3.9
trans-1,2-Dichloroethene	2.38	5.9	0.11	0.470	0.55	111	6.5
1,1,2-Trichlorotrifluoroethane	2.43	4.1	0.16	0.421	0.51	102	9.7
Iodomethane	2.48	14.6	0.07	0.634	0.54	108	4.3
Acetonitrile	2.78	6.4	0.12	2.929	0.55	109	7.1
Allyl Chloride	2.78	4.7	0.08	0.363	0.53	107	5.0
Methylene Chloride	2.87	5.0	0.09	0.559	0.52	103	5.7
Acetone	2.95	8.7	0.13	0.067	0.51	101	8.0
1,1-Dichloroethene	3.02	4.3	0.09	0.562	0.49	99	5.6
Methyl Acetate	3.08	4.3	0.05	1.828	0.48	97	3.3
Methyl-tert-butyl Ether (MTBE)	3.17	11.5	0.13	3.032	0.53	106	7.9
tert-Butyl Alcohol (TBA)	3.33	12.0	0.07	0.256	0.57	113	4.0
Diisopropyl Ether	3.56	6.8	0.09	6.283	0.58	115	5.1
Vinyl Acetate	3.56	2.9	0.08	3.524	0.55	109	4.8
Chloroprene	3.59	9.3	0.09	2.721	0.54	109	5.3
1,1-Dichloroethane	3.61	12.5	0.11	3.105	0.55	109	6.4
Acrylonitrile	3.68	4.9	0.08	0.624	0.55	109	4.4
Propionitrile	3.68	10.8	0.17	0.024	0.55	111	9.9
Ethyl-tert-butyl- Ether (ETBE)	3.90	10.0	0.11	4.779	0.50	101	6.7
cis-1,2-Dichloroethene	4.11	6.9	0.11	0.728	0.49	98	7.3
2,2-Dichloropropane	4.21	3.3	0.12	1.677	0.53	105	7.2
Bromochloromethane	4.29	7.7	0.16	0.377	0.48	95	10.6
Chloroform	4.38	2.4	0.08	1.846	0.55	110	4.4
Carbon Tetrachloride	4.47	7.1	0.14	0.758	0.55	110	8.1
Tetrahydrofuran	4.52	10.7	0.10	1.090	0.50	100	6.5
1,1,1-Trichloroethane	4.54	9.0	0.13	0.960	0.52	103	8.0
Dibromofluoromethane (SURR)	4.54	7.2		0.533	31.7	127	2.9
Methyl Acrylate	4.54	4.8	0.10	0.750	0.54	108	6.1
Ethyl Acetate	4.55	4.8	0.14	0.037	0.46	92	9.7
1,1-Dichloropropene	4.65	4.7	0.08	0.883	0.56	112	4.3
2-Butanone (MEK)	4.68	8.9	0.13	0.073	0.46	91	8.9
Benzene	4.88	4.6	0.10	5.001	0.55	109	5.6
Methacrylonitrile	4.95	5.7	0.06	0.286	0.52	103	3.8
1,2-Dichloroethane-d4 (SURR)	5.00	4.1		1.521	32.1	128	2.1
Pentafluorobenzene (IS)	5.01						

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Table V US EPA Method 8260 Soil Calibration, Accuracy, and Precision Data

Compound	Retention Time	Calibration			Accuracy and Precision (n=7, 0.5 ppb)[1]		
		Linearity RF (%RSD)	MDL (ppb)	Average RF	Average Concentration (ppb)	Accuracy (%)	Precision (%RSD)
tert-Amyl Methyl Ether (TAME)	5.03	6.4	0.11	1.593	0.51	102	7.2
1,2-Dichloroethane	5.07	7.0	0.11	1.221	0.55	109	6.5
1.4-Dioxane	5.37	13.8	0.13	0.004	0.50	100	8.3
Isopropyl Acetate	5.38	7.2	0.08	1.948	0.60	119	4.1
Trichloroethylene	5.41	7.0	0.13	0.408	0.49	98	8.7
1,4-Diflourobenzene (IS)	5.47						
Dibromomethane	5.78	5.0	0.10	0.249	0.47	94	6.9
1,2-Dichloropropane	5.87	3.6	0.11	0.914	0.50	100	7.1
Bromodichloromethane	5.95	6.2	0.12	0.696	0.50	100	7.6
Ethyl Methacrylate	6.15	8.5	0.05	0.435	0.44	87	3.7
Propyl Acetate	6.29	6.0	0.06	1.609	0.52	105	3.8
2-Chloroethyl Vinyl Ether	6.50	14.5	0.09	0.427	0.47	94	5.9
cis-1,3-Dichloropropene	6.53	6.3	0.05	1.086	0.44	88	3.3
Toluene-d8 (SURR)	6.69	4.9		1.062	25.8	103	2.1
Toluene	6.73	5.0	0.10	0.947	0.53	105	6.0
Tetrachloroethene	7.07	12.5	0.07	0.426	0.51	102	4.3
4-Methyl-2-Pentanone	7.13	8.4	0.12	0.018	0.45	90	8.8
trans-1,3-Dichloropropene	7.13	5.8	0.09	0.942	0.49	97	5.9
1,1,2-Trichloroethane	7.27	6.3	0.14	0.417	0.46	92	9.9
Methyl Methacrylate	7.33	13.2	0.09	0.792	0.48	96	5.7
Dibromochloromethane	7.41	4.9	0.09	0.421	0.48	97	5.9
1,3-Dichloropropane	7.51	3.8	0.12	1.042	0.50	101	7.4
1,2-Dibromoethane	7.61	4.3	0.10	0.299	0.49	97	6.5
2-Nitropropane	7.82	7.3	0.04	1.735	0.48	96	2.5
Butyl Acetate	7.84	8.9	0.08	1.675	0.46	92	5.5
2-Hexanone	7.90	9.4	0.08	0.380	0.54	109	5.0
Chlorobenzene-d5 (IS)	8.08						
Chlorobenzene	8.10	4.7	0.11	0.985	0.52	103	6.6
Ethylbenzene	8.14	4.7	0.10	1.757	0.52	103	6.2
1,1,1,2-Tetrachloroethane	8.16	7.8	0.09	0.713	0.51	101	5.9
m-,p-Xylene	8.27	14.3	0.08	0.561	0.98	98	2.6
o-Xylene	8.62	16.5	0.08	0.505	0.48	96	5.3
Bromoform	8.66	5.5	0.07	0.208	0.51	102	4.5
Styrene	8.66	8.0	0.11	0.818	0.48	95	7.3
Isopropylbenzene	8.87	14.9	0.07	1.318	0.43	86	4.9
Amyl Acetate	9.02	13.0	0.02	1.628	0.48	97	1.6
4-Bromofluorobenzene (Surr)	9.07	9.4		0.520	25.4	102	3.9
1,2,3-Trichloropropane	9.14	4.5	0.06	0.694	0.51	102	3.8
Bromobenzene	9.14	7.6	0.10	2.873	0.53	106	5.8
n-Propylbenzene	9.19	9.2	0.15	4.050	0.46	93	10.1
1,1,2,2-Tetrachloroethane	9.25	7.2	0.05	0.591	0.52	104	2.9
2-Chlorotoluene	9.29	7.6	0.13	2.539	0.49	99	8.3

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Table V US EPA Method 8260 Soil Calibration, Accuracy, and Precision Data							
Compound	Retention Time	Calibration			Accuracy and Precision (n=7, 0.5 ppb)[1]		
		Linearity RF (%RSD)	MDL (ppb)	Average RF	Average Concentration (ppb)	Accuracy (%)	Precision (%RSD)
1,3,5-Trimethylbenzene	9.35	13.9	0.10	2.519	0.44	89	7.2
cis-1,4-Dichloro-2-Butene	9.38	7.4	0.09	0.685	0.49	98	6.0
trans-1,4-dichloro-2-butene	9.38	4.6	0.05	0.594	0.50	100	2.9
4-Chlorotoluene	9.42	2.3	0.15	2.805	0.54	109	8.7
tert-Butylbenzene	9.57	6.8	0.05	2.557	0.44	89	3.8
Pentachloroethane	9.59	16.2	0.16	0.122	0.51	101	9.9
1,2,4-Trimethylbenzene	9.63	9.2	0.17	2.281	0.47	94	11.3
sec-Butylbenzene	9.70	13.6	0.05	3.050	0.49	99	3.5
p-Isopropyltoluene	9.81	14.4	0.15	2.829	0.49	98	9.5
1,3-Dichlorobenzene	9.84	8.0	0.07	1.787	0.53	106	4.2
1,4-Dichlorobenzene-d4 (IS)	9.89						
1,4-Dichlorobenzene	9.90	9.2	0.07	1.741	0.49	97	4.7
n-Butylbenzene	10.11	9.0	0.07	3.279	0.49	99	4.5
1,2-Dichlorobenzene	10.20	5.7	0.11	1.691	0.56	112	6.2
1,2-Dibromo-3-Chloropropane	10.76	7.9	0.11	0.399	0.57	114	5.9
Nitrobenzene	11.14	13.3	0.16	0.030	0.59	17	8.5
Hexachlorobutadiene	11.20	14.4	0.27	0.447	0.57	113	15.2
1,2,4-Trichlorobenzene	11.22	6.0	0.18	0.932	0.55	110	10.4
Naphthalene	11.43	11.1	0.12	3.322	0.56	113	6.7
1,2,3-Trichlorobenzene	11.55	9.4	0.09	0.998	0.58	116	4.9

1. Data from seven 0.5 ppb samples.

Figure 1 Total Ion Chromatogram of a Water Method 50 ppb VOC Standard Indicating Consistent Peak Shapes for all Compounds with No Water Interference.

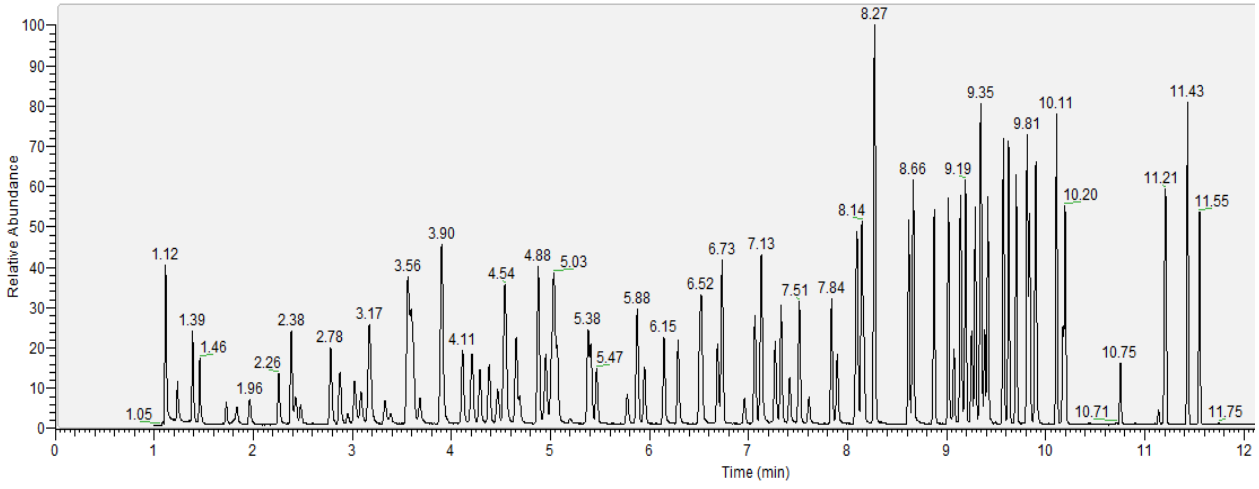

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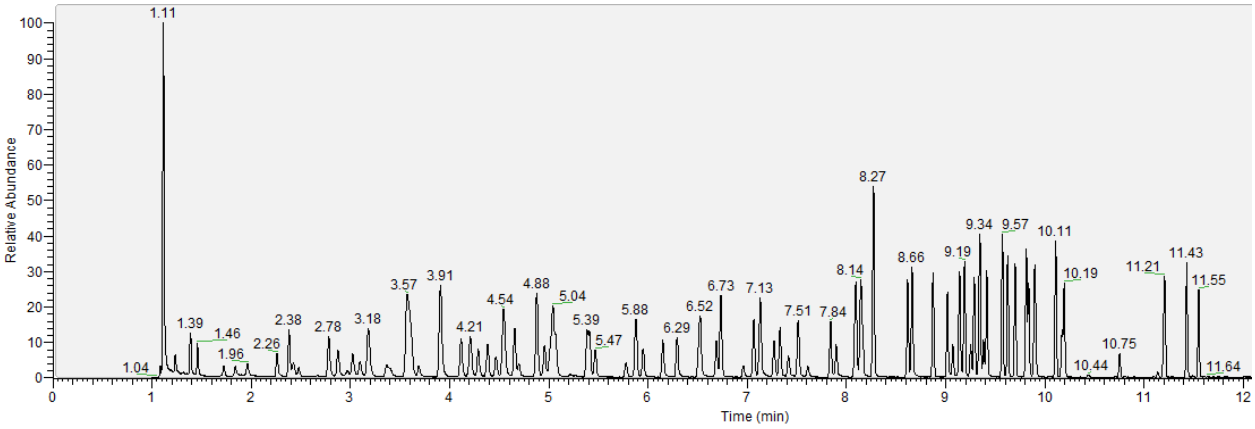
Figure 2 Total Ion Chromatogram of a Soil Method 50 ppb VOC Standard Indicating Consistent Peak Shapes for all Compounds with No Water Interference.



Conclusion

This study demonstrates the capability of the Teledyne Tekmar Atomx XYZ P&T system to process VOCs in water and soil samples following the US EPA Method 8260 in conjunction with Methods 5030 and 5035 with detection by a Thermo Scientific TRACE 1310 GC and ISQ MS. The %RSD of the calibration curve passed all method requirements. Furthermore, MDL, precision, and accuracy for seven 0.5 ppb standards for both the water and soil methods showed no interference from excessive water.

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.
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.
3. *Purge and Trap for Aqueous Samples*; US EPA, Office of Solid Waste, SW-846 Method 5030B, Revision 2, December 1996.
4. *Purge and Trap for Aqueous Samples*; US EPA, Office of Solid Waste, SW-846 Method 5030C, Revision 3, May 2003.

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