

APPLICATION NOTE

HAPSITE ER™ Portable GC/MS Chemical Identification System EPA TO-15 Gas Standard Mix Quantitation Method for Real-Time Analysis

INTRODUCTION

The EPA TO-15 method for Gas Chromatograph/Mass Spectrometer (GC/MS) air sampling is commonly used when monitoring air quality. In the TO-15 method, the sample is collected in an evacuated Summa canister (or equivalent) prior to introduction into a GC/MS for identification and quantification. Standards of the TO-15 analytes are commercially available for GC/MS calibration purposes.

INFICON has developed a quantitative method for the HAPSITE ER portable GC/MS Chemical Identification System to analyze for TO-15 analytes. The quantitative method contains a calibrated library of TO-15 analytes at detection limits of low to mid ppb (low to mid mg/m³). Using this method with HAPSITE ER eliminates the need for a sampling canister due to direct air sampling via the air probe. The sample is immediately introduced into the GC/MS and resulting data is available within minutes.

EXPERIMENTAL

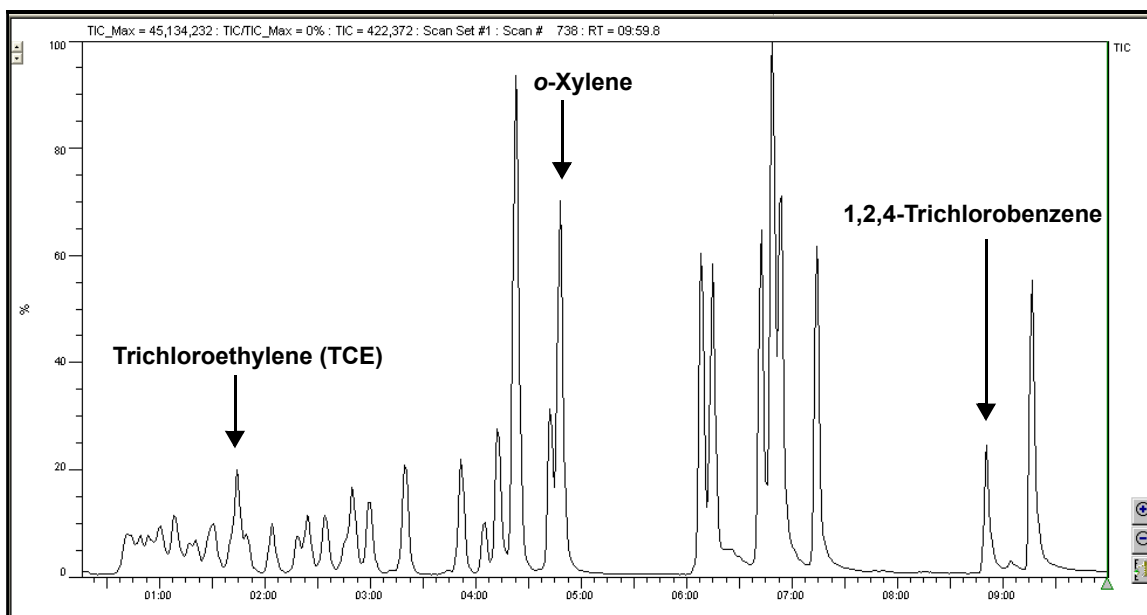
Various volumes of the TO-15 gas standard mix from Air Liquide American Specialty Gases were injected into a 1 L Tedlar bag filled with Ultra High-Purity (UHP) nitrogen to create ten calibration standards. The resulting concentrations were in the low to mid ppb (low to mid mg/m³) range. A 100 mL volume for each of the calibration standards was collected onto the internal Tri-Bed concentrator in HAPSITE ER via direct air sampling. Internal standards were automatically injected internally during sampling for calibration purposes.

Following the analysis of the ten calibration standards, the TO-15 gas standard mix calibration library was built and stored in the method file. Figure 1 displays an example chromatogram of the TO-15 analyte separation using the method created. Table 1 is a list of the 54 compounds including the quantitation ion (Q. Ion), retention time, and %RSD of Average Rf for each analyte.

CONCLUSION

Using the portable HAPSITE ER and air probe with the quantitative TO-15 analyte method eliminates the need to collect and store samples for later analysis. Collection and analysis of data occurs on-site and within minutes. Access to actionable data in minutes instead of days can save time, money, and lives when environmental air quality is of concern.

Figure 1: Chromatogram of the TO-15 Gas Standard Mix



Column: HP-1MS, 15 m, 0.25 mm id, 1.0 µm df

Volume Fill: 100 mL

Temperature Profile: 60°C (hold 2 min, 30 sec.) to 100°C at 10°C/min., to 180°C at 26°C/min. (hold 26 sec)

Table 1: Q. Ion, Retention Time, and RSD of Average Rf of the TO-15 Gas Standard Mix

Compound	Q. Ion (AMU)	Retention Time (min:sec)	RSD of Average Rf (%)
Freon 114 (1,2-Dichlorotetrafluoroethane)	170	00:42.0	29.68
1,3-Butadiene	54	00:43.0	27.17
Vinyl chloride	62	00:43.9	37.21
Bromomethane	94	00:46.0	30.08
Acetone	58	00:49.0	19.31
Freon 11 (Trichloromonofluoromethane)	136	00:49.8	29.63
1,1-Dichloroethene	96	00:53.5	25.67
Methylene chloride	84	00:54.7	29.25
Freon 113 (1,1,2-Trichlorotrifluoroethane)	186	00:55.2	26.59
Carbon disulfide	76	00:56.7	28.21
Vinyl acetate	43	01:00.7	21.92
cis-1,2-Dichloroethene	96	01:00.9	28.22
Methyl- <i>tert</i> -butylether	88	01:01.5	27.18
1,1-Dichloroethane	98	01:01.5	28.16
Methyl ethyl ketone (2-Butanone)	72	01:04.0	22.69

Table 1: Q. Ion, Retention Time, and RSD of Average Rf of the TO-15 Gas Standard Mix (Continued)

Compound	Q. Ion (AMU)	Retention Time (min:sec)	RSD of Average Rf (%)
<i>trans</i> -1,2-Dichloroethene	96	01:08.0	28.71
Ethyl acetate	88	01:09.2	29.67
Hexane	86	01:09.7	27.76
Trichloromethane (Chloroform)	118	01:10.5	26.72
Tetrahydrofuran	72	01:15.4	28.92
1,2-Dichloroethane	98	01:18.5	28.35
1,1,1-Trichloroethane	132	01:21.3	25.11
Benzene	78	01:28.2	29.73
Carbon tetrachloride	117	01:30.1	26.99
Cyclohexane	84	01:32.2	28.89
1,2-Dichloropropane	112	01:40.9	27.70
Bromodichloromethane	162	01:44.2	29.99
Trichloroethylene	130	01:44.9	28.78
Heptane	100	01:50.5	26.65
<i>cis</i> -1,3,-Dichloropropene	110	02:03.9	29.66
Methyl isobutyl ketone (MIBK)	100	02:04.5	29.13
<i>trans</i> -1,3-Dichloropropene	110	02:17.6	29.58
1,1,2-Trichloroethane	132	02:23.2	28.50
Toluene	91	02:32.6	29.68
2-Hexanone (MBK)	100	02:44.1	27.63
Dibromochloromethane	206	02:47.6	35.33
1,2-Dibromoethane	186	02:57.5	29.30
Tetrachloroethylene	164	03:18.1	38.72
Chlorobenzene	112	03:49.3	42.65
Ethylbenzene	91	04:10.5	31.93
Bromoform	173	04:19.8	29.45
<i>m</i> -Xylene and <i>p</i> -Xylene	91	04:20.7	30.64
Styrene	104	04:39.8	32.35
<i>o</i> -Xylene	91	04:45.1	28.00
1,1,2,2-Tetrachloroethane	166	04:45.1	28.14
<i>p</i> -Ethyltoluene	120	06:05.0	29.66
1,3,5-Trimethylbenzene	120	06:11.5	36.18

Table 1: Q. Ion, Retention Time, and RSD of Average Rf of the TO-15 Gas Standard Mix (Continued)

Compound	Q. Ion (AMU)	Retention Time (min:sec)	RSD of Average Rf (%)
1,2,4-Trimethylbenzene	120	06:38.6	26.86
1,3-Dichlorobenzene	146	06:44.0	28.35
Benzyl chloride	126	06:44.9	27.07
1,4-Dichlorobenzene	146	06:49.0	31.71
1,2-Dichlorobenzene	146	07:09.4	29.58
1,2,4-Trichlorobenzene	180	08:45.6	24.48
Hexachlorobutadiene	258	09:10.7	28.33



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