INFICON

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/m^3). 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

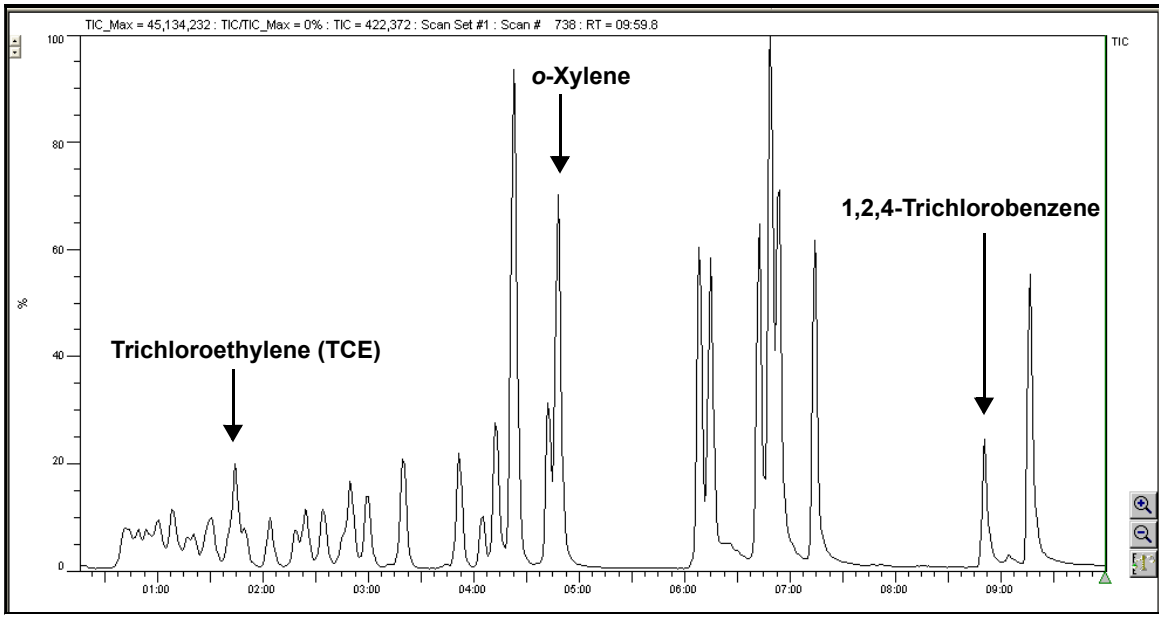
Various volumes of the TO-15 gas standard mix from Air Liquide American Specialty Gases were injected into a 1 L Tedlar bag filled with Ultra High-Purity (UHP) nitrogen to create ten calibration standards. The resulting concentrations were in the low to mid ppb (low to mid mg/m^3) range. A 100 mL volume 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 the environmental air quality is of concern.

Figure 1: Chromatogram of the TO-15 Gas Stanadard 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-*tert*-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 (%)
trans-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
cis-1,3,-Dichloropropene	110	02:03.9	29.66
Methyl Isobutyl Ketone (MIBK)	100	02:04.5	29.13
trans-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
m-Xylene and *p*-Xylene	91	04:20.7	30.64
Styrene	104	04:39.8	32.35
o-Xylene	91	04:45.1	28.00
1,1,2,2-Tetrachloroethane	166	04:45.1	28.14
p-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