GL Sciences

Application Note No. 015

Analysis of Semi-volatile Organics According to EPA Method 8270 [1]

Larry Garretson
Sjaak de Koning

Introduction

The ATAS 8270 Injector System has been developed to automate the rapid injection of large volumes of sample extract utilising the OPTIC 2 Injector. The ability to routinely inject larger volumes of solvent results in significant savings in the sample preparation laboratory. It is estimated that 65% of all costs associated with semi-volatile sample analysis result from sample preparation and concentration. By significantly increasing GC/MS sensitivity, sample volumes can be greatly reduced. Initial sample volumes can be reduced from 1000 mL to 50 mL or less. Corresponding decreases in solvent usage are also realised. Soil samples can be extracted and analysed without further concentration steps. Volatile surrogate recoveries show dramatic improvement.

The system makes use of the proven ATAS OPTIC2 Injector utilising a specialised replaceable liner containing ATAS 8270 packing material allowing up to 100 µL of solvent to be introduced to the GC/MS system. The ATAS 8270 packed liner has been carefully developed to assure all EPA 8270 method performance requirements are exceeded. Complete recovery of all analytes and responses of sensitive system performance compounds is assured. Extensive development has been conducted to produce the extremely inert materials required for successful implementation of the ATAS 8270 Injector System.

Instrumentation

- ATAS Optic 2-200 Programmable Injector
- HP 6890 Gas Chromatograph
- HP 7683 Automatic Liquid Sampler
- HP 5973 Mass Spectrometric Detector
- 30m x 0.25mm, 0.5µm film Restek XTI-5 column.

EPA Method 8270

Scope:

Method 8270 is used to determine the concentration of semi-volatile organic compounds in extracts prepared from many types of solid waste matrices, soils, air sampling media and water samples. The methodology contains extensive criterea to verify overall method compliance and acceptable GC/MS system performance.

Principle:

1. The samples are prepared for analysis by gas chromatography/mass spectrometry (GC/MS) using the appropriate sample preparation and, if necessary, sample cleanup procedures.
2. The semi-volatile compounds are introduced into the GC/MS by injecting the sample extract into a GC with a narrow-bore fused-silica capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a MS interfaced to the GC.
3. Analytes eluted from the capillary column are introduced into the MS. Identification of the target analytes is accomplished by comparing their mass spectra with the electron impact spectra of authentic standards. Quantification is accomplished by comparing the response of a major ion relative to an internal standard using a five-point calibration curve.
4. The method includes specific initial and continuing calibration criteria and quality control steps that supersede general GLP requirements.

Standard 8270 Chromatogram

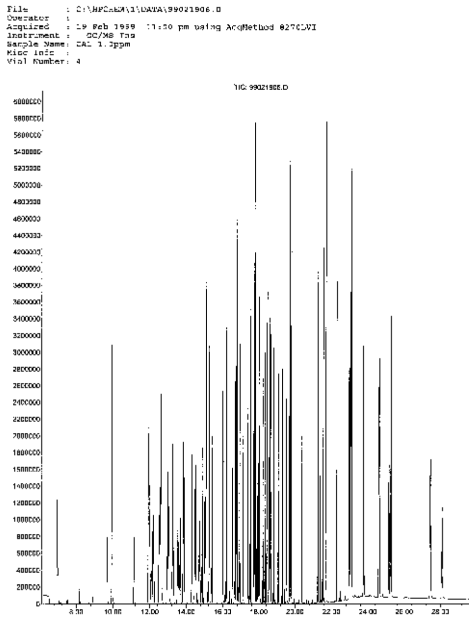

Figure 1: 30 µL of 1.0 ng/µl EPA 8270 standard. 30 m x 0.25 mm, 0.5 µm film Restek XTI-5 column. 40-135 °C @ 20 °C/min, IH=3 min, then 135-320 °C @ 10 °C/min.

Compound list

1,4-Dichlorobenzene-d4; Pyridine; Aniline; 2-Fluorophenol; Phenol-d6; Phenol; 2-Chlorobenzene; 1,3-Dichlorobenzene; 1,4-Dichlorobenzene; 1,2-Dichlorobenzene; Benzyl alcohol; Bis(2-chloroisopropyl)ether; 2-Methylphenol; Hexachloroethane; N-Nitroso-di-n-propylamine; 4-Methylphenol; Naphthalene-d8; Nitrobenzene-d5; Nitrobenzene; Isophorone; 2-Nitrophenol; 2,4-Dimethylphenol; Bis(2-chloroethoxy) methane; Benzoic acid; 2,4-Dichlorophenol; 1,2,4-Trichlorobenzene; Naphthalene; 4-Chloroaniline; Hexachlorobutadiene; 4-Chloro-3-methylphenol; 2-Methylnaphthalene; Acenaphthene-d10; Hexachlorocyclopenta diene; 2,4,6-Trichlorophenol; 2,4,5-Trichlorophenol; 2-Fluoro biphenyl; 2-Chloronaphthalene; 2-Nitroaniline; Acenaphthylene; Dimethyl phthalate; 2,6-Dinitrotoluene; Acenaphthene; 3-Nitro aniline; 2,4-Dinitrophenol; Dibenzofuran; 2,4-Dinitrotoluene; 4-Nitrophenol; Fluorene; 4-Chlorophenyl phenyl ether; Diethyl phthalate; 4-Nitroaniline; Phenanthrene-d10; 4,6-Dinitro-2-methyl phenol; N-Nitrosodiphenylamine; 2,4,6-Tribromophenol; Phenanthrene; Anthracene; Bi-n-butyl phthalate; Fluoranthene; Chrysene-d12; Benzidine; Pyrene; 4-Terphenyl-d14; Butyl benzyl phthalate; 3,3'-Dichlorobenzidine; Benzo[a]anthracene; Chrysene; Bis(2-ethylhexyl) phthalate; Perylene-d12; Di-n-octyl phthalate; Benzo[b]fluoranthene; Benzo[k]fluoranthene; Benzo[a]pyrene; Indeno[1,2,3-cd]pyrene; Bibenz[a,h]anthracene; Benzo[g,h,i] perylene.

Conclusions

The ATAS 8270 Injector System has demonstrated the ability to exceed all Method 8270 performance criteria. The system has proven to be automatable, rugged and reproducible. By optimising the rapid injection of large extract volumes, the ATAS 8270 Injector System provides significant cost savings in the sample preparation laboratory.

GL Sciences B.V.
De Sleutel 9, 5652 AS, Eindhoven, The Netherlands
Tel. +31 (0)40 254 95 31   E-mail: info@glsciences.eu
Internet: www.glsciences.eu

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GCMS total ion chromatogram courtesy of DHL Analytical, Round Rock, Texas, USA.

References

[1] USEPA SW-846, Method 8270C, Revision 3, December 1996.

HP6890/5973 with OPTIC2 8270 Injection System

GL Sciences B.V.
De Sleutel 9, 5652 AS, Eindhoven, The Netherlands
Tel. +31 (0)40 254 95 31   E-mail: info@glsciences.eu
Internet: www.glsciences.eu