APPLICATION BRIEF

GAS CHROMATOGRAPHY / MASS SPECTROMETRY

Thermal Desorption-GC/MS Analysis of Polycyclic Aromatic Hydrocarbons on Fine Particulates in Air

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Introduction

Polycyclic aromatic hydrocarbons (PAHs) are commonly found throughout the environment in soil, water and adsorbed to fine particulate matter in air. Of the 16 common PAHs, 7 have been classified as animal carcinogens by the International Agency for Research on Cancer (IARC). Resulting from this classification, PAHs are monitored and regulated in the environment. Analysis of PAHs in soil and water is performed with a solvent extraction of the sample matrix and liquid injection into a GC/MS system; a similar technique has been applied to monitoring PAHs adsorbed to the surface of fine particulates in air. A common method of analyzing for PAHs in airborne particles is the California Air Resources Board Method 429. Although Method 429 is both precise and accurate, it requires collecting an air sample on a resin and subsequent extraction with methylene chloride; this technique is both time consuming and requires the use of a hazardous solvent. Presented in this paper is a technique which will use automated thermal desorption to introduce PAHs collected on a glass fiber filter into a GC/MS system; this technique will eliminate the use of solvents and reduce the sample-preparation time dramatically. The application of ATD to PAH analysis is typically difficult because the complete sample path must be heated to prevent severe tailing and carryover of analytes. The method and data presented here will demonstrate the successful analysis of all 16 common PAHs by thermal desorption.

Experimental

The PerkinElmer® Clarus® 600 Gas Chromatograph/Mass Spectrometer (GC/MS) with a PerkinElmer TurboMatrix™ 650 Automated Thermal Desorber (ATD) was the instrumental platform utilized in this paper. Standards were prepared in methanol and spiked onto ATD tubes that were packed with Tenax TA. Particulate matter from diesel exhaust was collected onto a glass fiber filter paper; the filter was rolled and placed into a glass ATD tube.

PerkinElmer® precisely.

A summary of the instrumental conditions follows. The sample tube was desorbed for 15 minutes at 320 ˚C; the sample was collected onto a cold trap. The cold trap was subsequently desorbed at 300 ˚C across a heated transfer line onto a PerkinElmer Elite-5ms column (30 m x 0.25 mm x 0.25 µm). The GC oven program utilized had a starting temperature of 100 ˚C with a hold of 5 minutes, the oven was ramped at 6 ˚C/min to 250 ˚C with no hold, and finally ramped at 10 ˚C/min to 330 ˚C where it was held for 10 minutes. The mass spectrometer scanned from m/z 60 through m/z 400, with a scan time of 0.25 seconds and an inter-scan delay of 0.05 seconds.

Discussion

Figure 1 below illustrates the chromatographic performance of the analysis of PAHs by ATD. This is a result of the rapid desorption and transfer of all 16 PAHs to the gas chromatograph, from naphthalene through benzo(g,h,i)perylene.

Conclusion

Demonstrated here is a fully automated ATD method capable of desorbing PAHs from both adsorbent packed tubes and from glass fiber filters. This method is simple, robust and reduces the use and solvents in the analysis of PAHs in fine particulate matter.

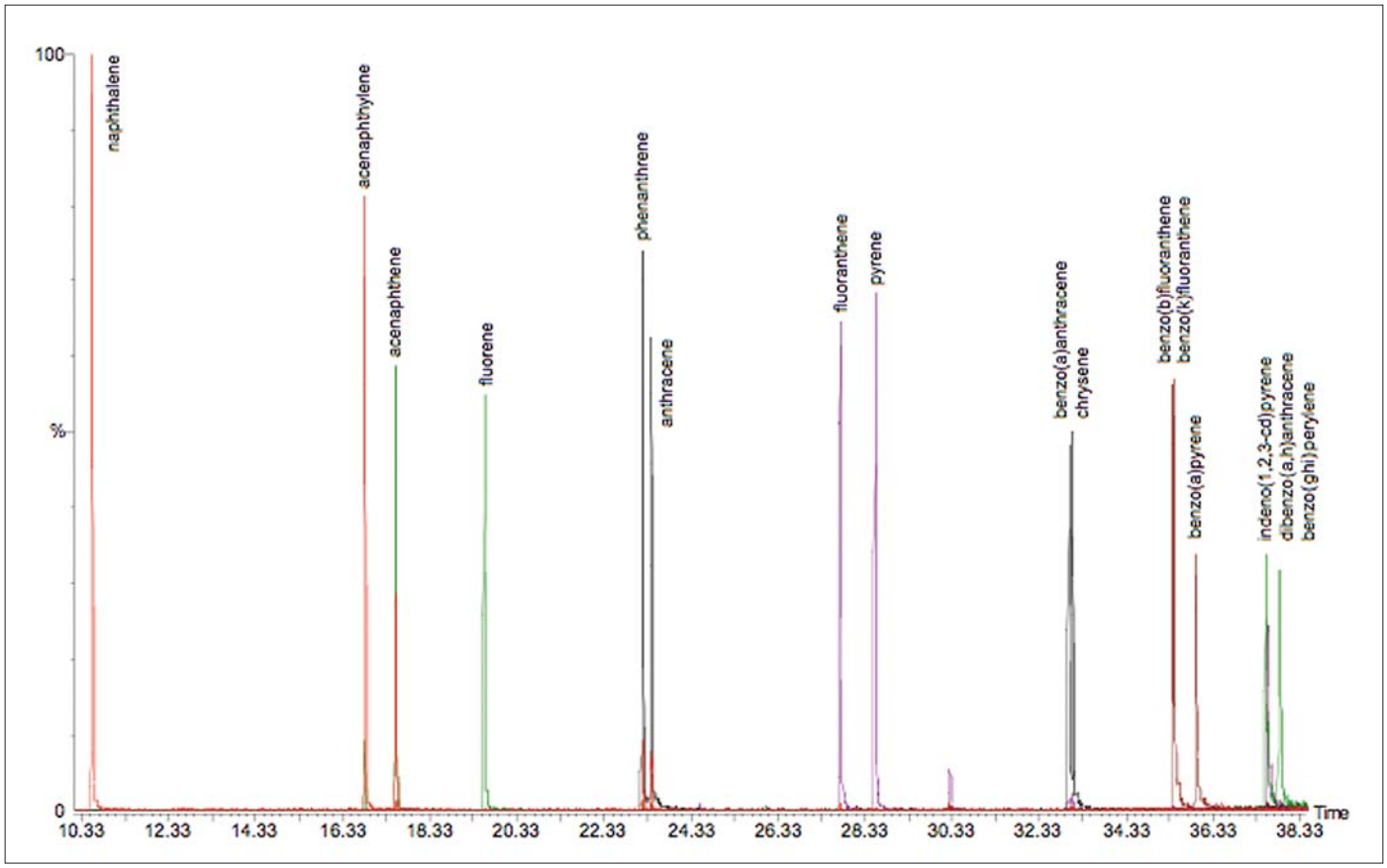

Figure 1. An extracted ion chromatogram of a 5 ng PAH standard desorbed from a Tenax TA-packed ATD tube.

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