3-in-1 Solution for Mobile Forensic Applications

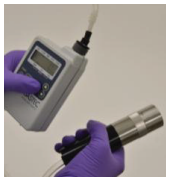
Application Note

Author

Suli Zhao
Agilent Technologies, Inc.

Abstract

The Agilent 5975T LTM GC/MS, when configured with the Capillary Trap Sampler (CTS) and Thermal Separation Probe (TSP), is capable of measuring compounds of interest in vapor, liquid, and solid material. The CTS and TSP solution makes the sample preparation easy and simple. The 5975T LTM GC/MS provides unprecedented sample analysis speed, allowing you to get the results when and where you need it.



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Introduction

The transportable GC/MS provides the necessary fast measurements required for in-the-field forensic work. Typical forensic analysis may include looking for residual evidence of drugs of abuse and accelerants. The organic compounds being tested may be hidden in the air, in blood, or even in a piece of charred wood. The CTS/TSP accessory provides a 3-in-1 solution by allowing the customer to sample for organic compounds in a gas, liquid or solid matrix.

CTS and TSP

Agilent has developed an innovative capillary trap sampler (CTS) based on SnifProbe technology [1], which enables gas sampling within a few seconds to a few minutes in the field. The CTS uses a miniature pump to suck air through short capillary columns that adsorb airborne compounds. It can be loaded with six 20-mm trapping columns simultaneously. Its handheld design and sampling speed make it ideal for field sampling.

After collecting a sample, the loaded capillary columns are transferred to a disposable microvial. The microvial is placed into the TSP probe and then inserted into a heated split/splitless inlet for quick desorption. After analysis is complete, the TSP is removed from the injector and the microvial is thrown away. This design completely eliminates the time-consuming and expensive cleanup typically associated with dirty samples.

Gas phase sample identification

Gasoline in fire debris

The aromatic compounds that have the characteristic ion of *m/z* 91 are special in gasoline. These masses represent molecular weights of the more abundant aromatic compounds found in gasoline. To demonstrate the capabilities of the 5975T LTM GC/MS, a study was performed to compare the aromatic compounds in the gasoline. The benefits of using the CTS with the TSP include the elimination of any solvent wash procedure as well as only collecting airborne vapor. This resulted in minimal matrix interference in the GC/MS chromatogram.

Figure 1 shows an overlap EIC of a gasoline standard and gasoline residue from fire debris. The black chromatogram is a typical gasoline chromatogram and blue is the sample. The fire debris sample was the ashes of a pair of burned jeans at the conclusion of a fire. Figure 1 clearly shows good correlation between a gasoline standard and the vapor collected from the ashes. Comparing the components relative contents and types can give a positive conclusion that the fire was caused by gasoline.

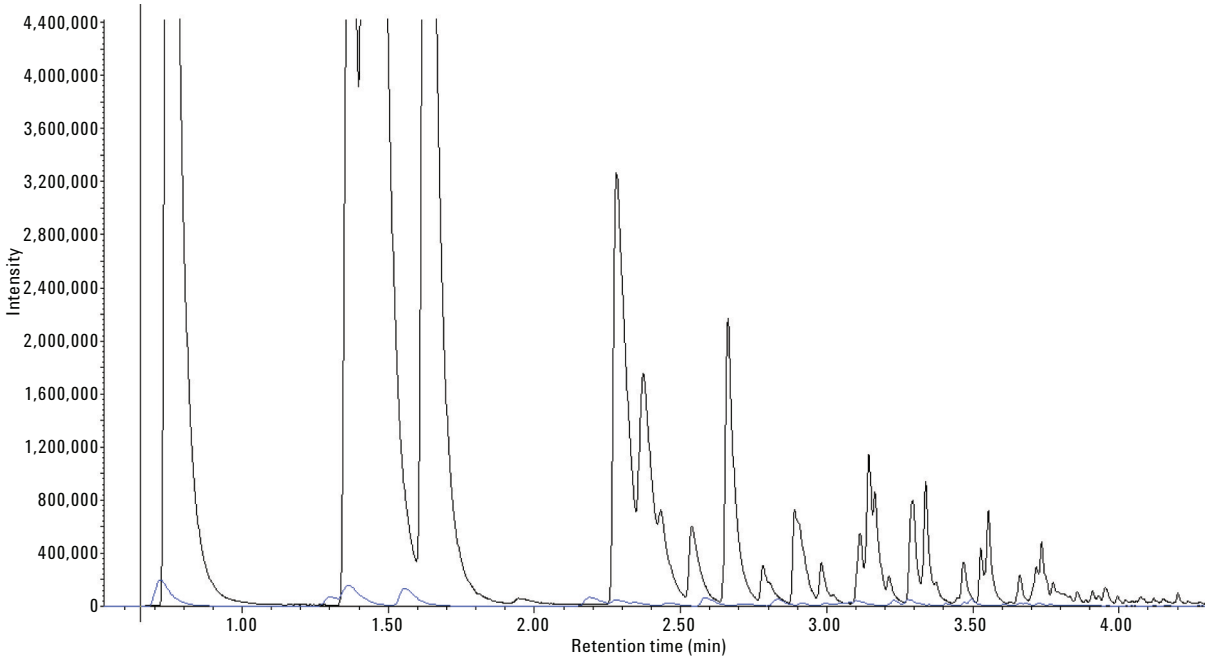

Figure 1. Mass chromatograms of fingerprints of Gasoline (m/z 91). Gasoline standards (black) and fire debris caused by gasoline (blue).

Liquid phase sample

Drug detection in whole blood

A new rapid qualitative method for detection of drugs in whole blood was developed using the thermal separation probe (TSP) sample introduction technique on the transportable 5975T LTM GC/MS [2]. No sample preparation was required for the blood samples, and Deconvolution Reporting Software (DRS) helped sort out the target drugs from the GC/MS data with a lot of matrix interference. The method can achieve a method detection limit (MDL) of 5 ng/µL for > 94% of the 56 thermally stable drugs analyzed.

A 3 µL blood sample from a fatal overdose subject was used (without sample preparation) to test the method (Figure 2). The baseline is low and very smooth, implying that the volatile components in blood can be eluted completely with this method. The tallest peak in this sample is cholesterol, and the other large, visible peaks are primarily long-chain fatty acids. The drugs of abuse are hidden in these large peaks. With the help of DRS and the NIST Automated Mass Spectral Deconvolution and Identification Software (AMDIS), the drugs of abuse present in this sample were identified accurately. Figure 2 shows the deconvolution result for the drug chlorpromazine.

Solid phase sample

Solid explosive

Explosives are designed to perform work and are generally recognized as energetic materials. While explosives have many legitimate uses in mining and construction, they have also been used in criminal acts. As a result of the illegal use of explosives, investigators are faced with providing critical information that often uses instruments to detect and identify energetic compounds. A 5975T LTM GC/MS with TSP can provide an easy and convincible way to deal with solid explosives. Put a little powder of explosive into a TSP microvial and inject it directly. Figure 3 is a TIC of DNT explosive.

As demonstrated in this application note, being able to produce lab-quality data with the 5975T LTM GC/MS in conjunction with the CTS/TSP provides the forensic scientist with a 3-in-1 solution. Being able to collect samples in solid, liquids, or gas vapor at the scene and quickly obtain a lab-quality result is a forensic scientist's best tools for reliably solving a problem in the field.

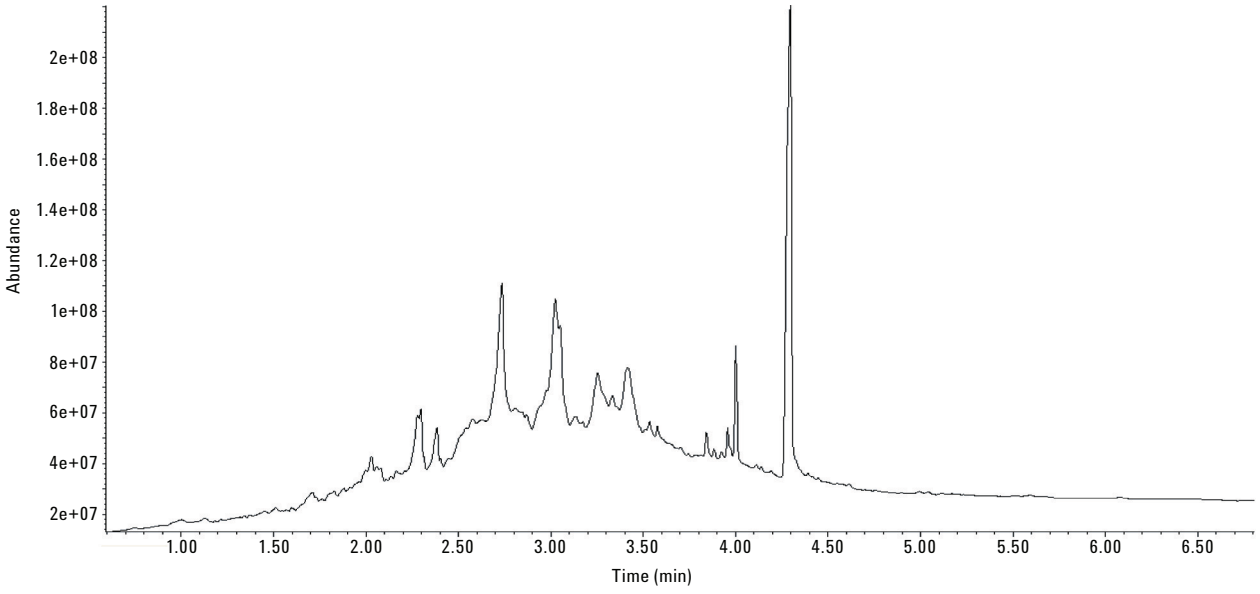

Figure 2. TIC chromatogram from a blood sample taken from an overdose subject.

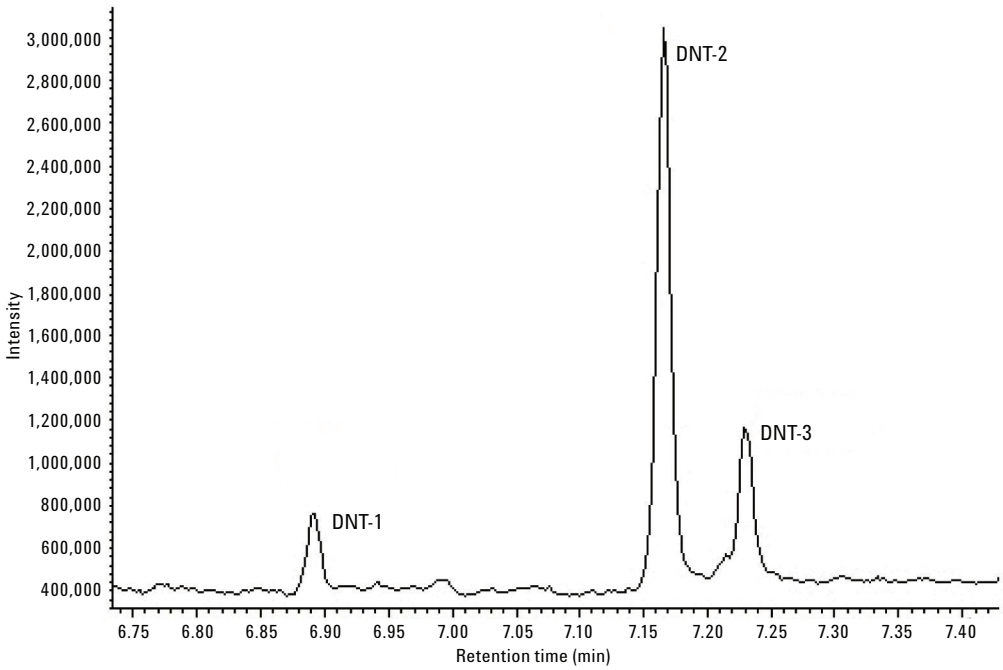

Figure 3. TIC of DNT isomers.

References

1 S. Zhao, Fast Analysis of Fire Debris Using an Agilent 5975T LTM GC/MSD with CTS, Agilent publication number 5991-3439EN.

2 S. Zhao, A rapid method for detection of drugs of abuse in blood samples using the thermal desorption probe and the 5975T LTM GCMS, Agilent publication number 5991-0333EN.

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