INFICON

APPLICATION NOTE

Solid Phase Microextraction (SPME) and HAPSITE ER: Detection of Explosives and Explosive Taggants in Air

SUMMARY

The HAPSITE® ER is a rugged, person-portable GC/MS instrument used for the detection of volatile and semi-volatile organic compounds (VOCs and SVOCs). The HAPSITE ER SPME Sampling System, attached to the HAPSITE via its universal interface, provides the means to introduce SVOCs into HAPSITE ER. SPME is an effective extraction technique that has been successfully employed in the field for the pre-concentration of a variety of compounds. Many organic high explosives and explosive taggants do not have a high enough vapor pressure for effective vapor sampling. However, these explosives and their commercial explosive mixtures have characteristic components detectable by GC/MS. SPME sampling will readily extract these compounds from air. A study was carried out to evaluate SPME extraction, followed by introduction to the SPME Sampling System thermal desorption chamber and HAPSITE ER compound detection and identification, of the following explosives taggants: 2-nitrotoluene (2-NT), 3-nitrotoluene (3-NT), 4-nitrotoluene (4-NT), 2,3-dimethyl-2,3-dinitrobutane (DMNB) and common explosives: 2,4-dinitrotoluene (2,4-DNT), 2,6-dinitrotoluene (2,6-DNT), and triacetone triperoxide (TATP) (see Table 1).

EXPERIMENTAL

A PDMS/DVB (blue) fiber was chosen for extraction of the explosives and taggants from air due to its ability to effectively adsorb nitropolyanion groups bonded to most of the compounds. Fifty nanograms (ng) of each component of an EPA method 529 calibration standard, supplemented with an additional 100 ng of the mixture's explosives components 2,4-DNT and DMNB were injected into an empty 40 mL VOA vial to simulate sampling from air. Five hundred nanograms of a third explosive, TATP, were also injected into the vial. A PDMS/DVB SPME fiber with protective fiber holder was inserted into the 40 mL VOA vial through the PTFE septum. The fiber was extended carefully and exposed to the sample for 10 minutes. Following exposure, the SPME fiber was carefully retracted, removed from the vial, and brought to HAPSITE ER for analysis. The fiber holder was inserted into the SPME Sampling System desorption chamber. The SPME fiber was then exposed inside the 250 °C desorption chamber which was attached to the injection port of HAPSITE ER via the universal interface. A 15 minute sample separation and analysis run was carried out with the mass spectrometer scanning from 43 to 300 amu at a rate of 1.0 scan/sec. Method conditions and the resulting chromatogram are shown in Figure 1.

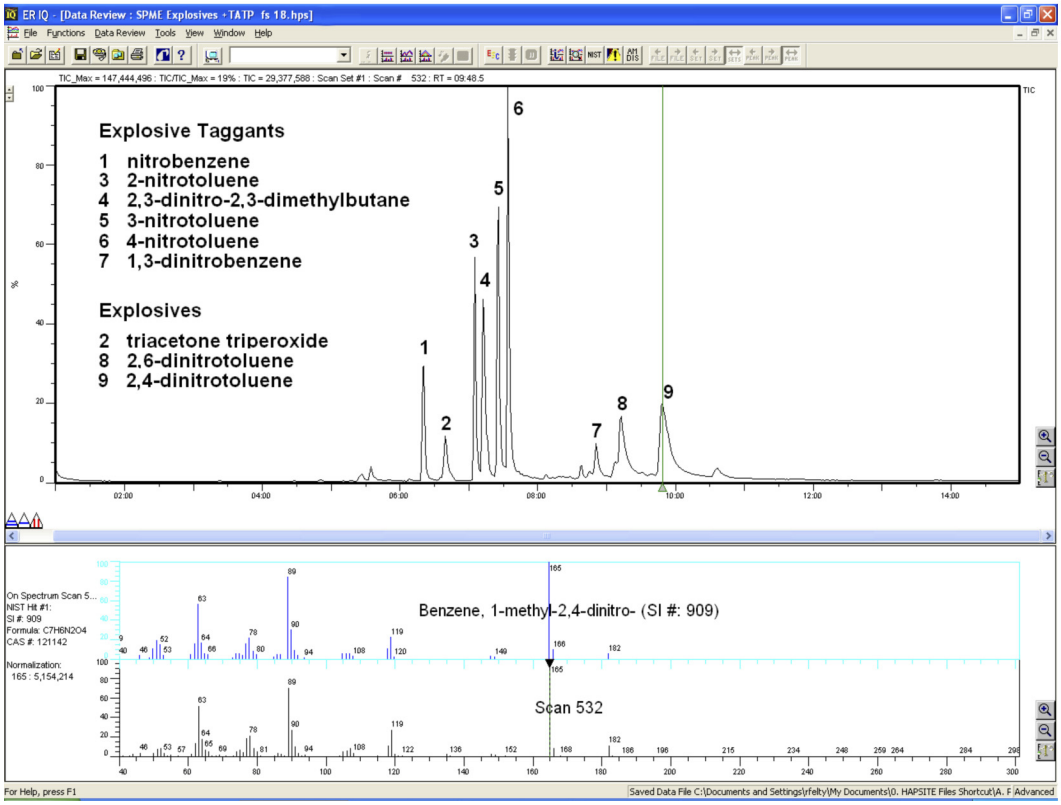
CONCLUSIONS

This study demonstrates the increased versatility of HAPSITE ER with the addition of the SPME Sampling System. Semi-volatile explosives and explosive taggants can be extracted from an air sample with a SPME fiber and introduced into the HAPSITE ER for analysis.

Table 1: Explosive Taggants and Explosives in Study

	Analyte Name	CAS Number	Retention Time
1	nitrobenzene	98-95-3	6:19.7
2	triacetone triperoxide	17088-37-8	6:39.4
3	2-nitrotoluene	88-72-2	7:04.5
4	2,3-dimethyl-2,3-dinitrobutane	3964-18-9	7:12.8
5	3-nitrotoluene	99-08-1	7:25.2
6	4-nitrotoluene	99-99-0	7:34.6
7	1,3-dinitrobenzene	99-65-0	9:08.0
8	2,6-dinitrotoluene	606-20-2	9:12.1
9	2,4-dinitrotoluene	121-14-2	9:48.5

Figure 1: Total Ion Chromatogram (TIC) of 6 Explosive Taggants and 3 Explosives



Column: Rtx-1MS (15 m x .25 mm x 1.0 µm)
Column temperature program: 60 °C held for 0.5 minutes, ramp at 30 °C/min. to 160 °C, ramp at 24 °C/min. to 200 °C, hold for 10 minutes.

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