New MEGA-TNT 8095 FAST Column, for FAST Explosives Analysis

Overview

Analyses of explosives mixture is complicated by the unstable nature of the compounds themselves. Some substances, particularly HMX, tend to decompose first in the injection port and then in the chromatographic column, both for the effects of temperature and activity of the column.
At the present time, to analyze and separate all the explosives listed in US EPA 8095 method requires two chromatographic columns, since one single column is not sufficient to separate at the base line all the compounds. Furthermore, the shape of the resulting peaks are often not good presenting tailed peaks for the phenomena of absorption-activity that are generated into the column, in addition to thermal degradation mentioned above.
MEGA presents a new approach to the problem, with a new FAST Column called **MEGA-TNT 8095 FAST**, developed to have a minimal surface activity for this class of compounds. The solution of FAST-GC by side the new stationary phase, is very important because with short columns we can reduce the time that the compounds stay in the column, thus lowering the elution temperature, finding a compromise with temperature rate of the analysis of course. In this way, thanks to the great inertness of this new column and minimizing the thermal degradation problems in the column, we avoid decomposition and deformation of the peaks that are very sensible to those effects. The specific selectivity of the new stationary phase and the employ of a reduced inner diameter (100 µm) finally allows a complete separation of all the listed compounds with a perfect peak shape and minimizing thermal degradation/alteration in the column. All this in less than 9 min analysis with a single column!
See the chromatogram below and the method description.

Method and Conditions

A mixture of 18 explosives compounds listed in US EPA Method 8095 was analyzed. The mixture was composed with the standards listed below in 1:1:1 proportions:

- 8095 Calibration Mix A (Restek Cat.# 31607)
- 8095 Calibration Mix B (Restek Cat.# 31608)
- 3,4 dinitrotoluene (ISTD, Restek Cat.# 31452)

Column: MEGA-TNT 8095 FAST, 100µm i.d. x 0.20µm f.t. x 6m

Oven: 80°C – 22°C/min – 280°C

Carrier Gas: Hydrogen @ 140 kPa constant pressure

Injector: New FAST On-Column Inlet System(*), 4nl injected directly as liquid into the column!
(*): patent pending product, commercialized by DANI Instruments Spa

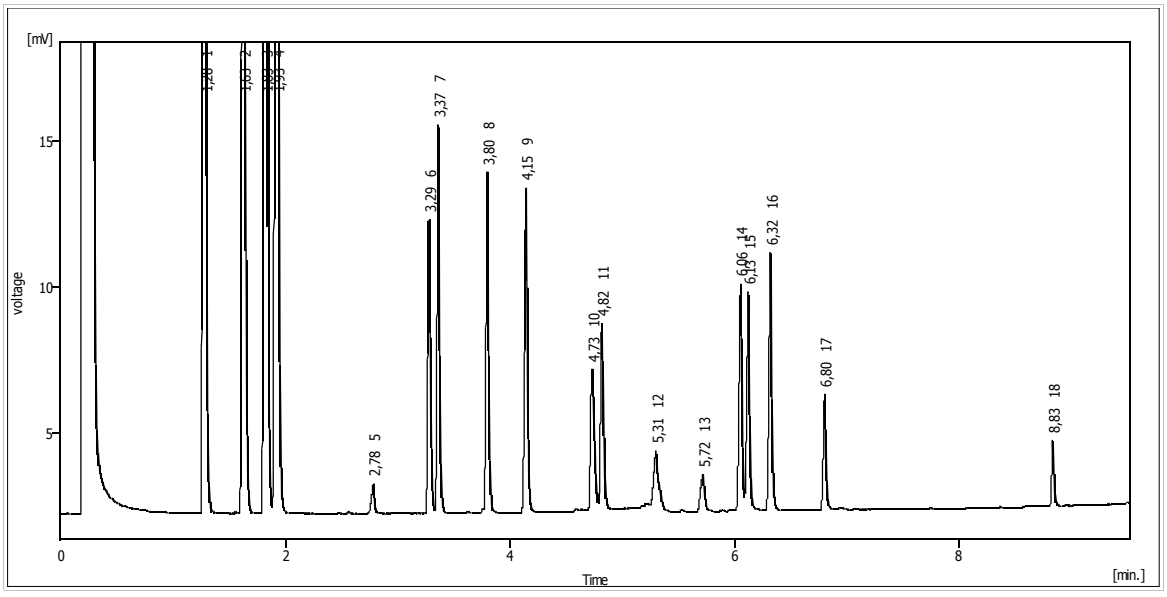
Detector: FID, 300°C

You can visit our website www.mega.mi.it to find a free Pdf guide to FAST-GC technique in the "Support/Download" page, to learn more about conditions and fundamental parameters for easily use FAST-GC.

The analysis was carried out with a DANI Master GC.

Results

The chromatogram shows a perfect peak shapes and a complete resolution of all 18 compounds listed in the table 1.
Using 22°C/min as temperature rate is a good compromise to allow fast analysis and keep an elution temperature of the last compound low enough to avoid thermal decomposition in the column. The elution temperature of HMX is about 260°C; these are suitable conditions to work with even with a GC-MS system.



Peak #	Ret Time [min]	Peak Name
1	1.20	Nitrobenzene
2	1.63	2-nitrotoluene
3	1.83	3-nitrotoluene
4	1.93	4-nitrotoluene
5	2.78	Nitroglycerin
6	3.29	3,4-dinitrotoluene (ISTD)
7	3.37	2,6-dinitrotoluene
8	3.80	1,3-dinitrobenzene
9	4.15	2,4-dinitrotoluene

Peak #	Ret Time [min]	Peak Name
10	4.73	2,4,6-trinitrotoluene
11	4.82	1,3,5-trinitrobenzene
12	5.31	PETN
13	5.72	4-amino-2,6-dinitrotoluene
14	6.06	RDX
15	6.13	3,5-dinitroaniline
16	6.32	2-amino-4,6-dinitrotoluene
17	6.80	Tetryl
18	8.83	HMX

Table 1: Peak identification and information.

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