Application Note: ANCCSHYPGOLDEXP

Analysis of Nineteen Explosives Using a Hypersil GOLD aQ HPLC Column

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Key Words

- Hypersil GOLD aQ
- Explosives
- EPA 8330

Abstract

This application note demonstrates the use of the Thermo Scientific Hypersil GOLD aQ column for the analysis of nineteen explosives, including those mentioned in EPA method 8330.

Introduction

Explosive compounds can be categorized according to their chemical structure, with the major categories being nitroaromatics (e.g. TNT), nitroamines (e.g. RDX and HMX), nitrate esters (e.g. PETN and EGDN) and peroxides.

Explosives are commonly used in a number of industries, which include: Construction, demolition, mining and pyrotechnics. In this application note we demonstrate the separation of nineteen explosives using a method which is compatible with MS detection.

Experimental Details

Chemicals and Reagents	Part Number
Fisher Scientific HPLC grade water	W/0106/17
Fisher Scientific HPLC grade acetonitrile	A/0626/17
Fisher Scientific HPLC grade methanol	M/4056/17

Sample Handling Equipment	
NSC Mass Spec Certified 2 mL clear vial with blue bonded PTFE silicone cap	MSCERT4000-34W

Separation Conditions		
Instrumentation:	Thermo Scientific Accela HPLC/UHPLC	
Column:	Hypersil GOLD® aQ 3 µm, 250 x 4.6 mm	25303-254630
Measured pressure:	290 bar	
Column temperature:	35°C	
Injection volume:	25 µL	
Flow rate:	1.0 mL/min	
UV detection:	245 and 215 nm	
Mobile phase:	50:45:05 (v/v) water + 0.1% formic acid/ methanol + 0.1%formic acid/ acetonitrile + 0.1% formic acid	

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Results

The analysis was carried out on a Hypersil GOLD aQ 3 µm, 250 x 4.6 mm column. Nineteen explosives are separated in less than 25 minutes using an isocratic mobile phase (Figure 1).

As shown in Figure 2, reducing the detection wavelength to 215 nm increases the response of some of the compounds, especially peaks 4 and 10 (EGDN and nitroglycercin). However, this also results in increased baseline noise indicating that the method would be suited to MS detection, which would also give enhanced specificity.

Replicate injections of the test mix showed that Hypersil GOLD aQ produced reproducible results (Table 1).

Peak position	Name	t_R	%RSD t_R
1	2,6-diamino-4-nitrotoluene	3.66	0.19
2	HMX	4.35	0.27
3	RDX	5.71	0.34
4	EGDN	5.91	0.38
5	1,3,5-trinitrobenzene	6.86	0.33
6	1,3-dinitrobenzene	8.16	0.43
7	Nitrobenzene	8.84	0.40
8	Tetryl	9.83	0.66
9	TNT	10.47	0.52
10	Nitroglycerin	10.67	0.56
11	4-amino-2,6-dinitrotoluene	10.89	0.70
12	2-amino-4,6-dinitrotoluene	11.50	0.75
13	2,6-dinitrotoluene	11.80	0.57
14	2,4-dinitrotoluene	12.12	0.59
15	2-nitrotoluene	13.38	0.54
16	4-nitrotoluene	14.45	0.58
17	3-nitrotoluene	15.32	0.58
18	PETN	21.05	0.68
19	HNS	24.44	1.30

Table 1: Method precision (%RSD) for nineteen explosives (data calculated from six replicate injections)

Conclusions

Nineteen explosives were successfully separated on Hypersil GOLD in less than 25 minutes. Hypersil GOLD aQ columns can separate compounds with similar chemical structures allowing for faster sample throughput. For increased sensitivity and specificity, Hypersil GOLD aQ columns are compatible for use with MS detection.

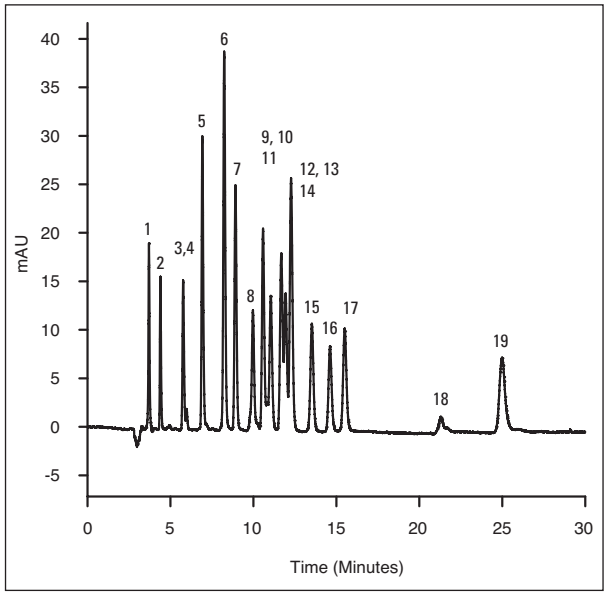

Figure 1: Chromatogram for nineteen explosives (wavelength 254 nm) on a Hypersil GOLD aQ 3 µm, 250 x 4.6 mm column

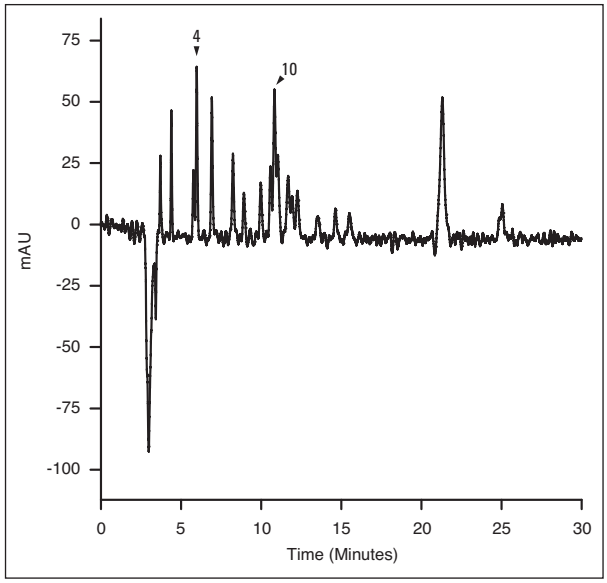

Figure 2: Chromatogram for nineteen explosives (wavelength 215 nm) on a Hypersil GOLD aQ 3 µm, 250 x 4.6 mm column

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