BUCK Scientific

Application Note
#LC9001

Measurement of Explosive Residues from Munitions and Armaments by Isocratic HPLC

The government and the military have spent millions of dollars on making millions of tons of explosive materials. Most of these materials are warehoused in storage depots and often-present problems with leaking containers and contamination of the surrounding environment. Some are still used for testing and need to be checked for residual contamination and combustion efficiency. The industrial community, particularly the mining, roadway construction and building contractor businesses, often use explosives for excavation, demolition and renovation purposes; and they, too, must check for any uncombusted residues at the specific job sites, or evaluate the quality / freshness of an explosive compound or mixed formulation as to the purity and composition, respectively.

Many of the compounds used for this type of work are all related, in that their chemical composition consists of some form or organic nitrate. The most famous of these, Tri-Nitro-Toluene, or TNT is a simple organic compound that decomposes into a variety of residual compounds. Nitro-Glycerin, known as NG in the industry, is the basis for Alfred Nobel's dynamite. Both the espionage and terrorist communities have, unfortunately for the rest of us, developed a fairly extensive assortment of rather innovative and efficient "designer explosive", often referred to as "plastiques". These explosive polymers can be formed into shapes to direct the blast; or be molded into some unassuming shape for more sinister purposes. These specialized materials, also synthesized from some Nitrate-based chemical; leave characteristic residues after detonation that can be used to "fingerprint" the original compound. This is the foundation of criminalistic forensics and the Bureau of Alcohol, Tobacco & Firearms has amassed a tremendous library of all the different materials encountered in the explosives area.

Since many of these "residual" contaminants from explosives are quite polar, and sometimes even ionic; Reverse-Phase Chromatography makes an ideal analytical technique for the separation of these chemicals. Due to their molecular functionalist, the aromatic and nitro-bearing portions of these molecules provides excellent sensitivity using several UV wavelengths. The Buck Scientific BLC-20D Variable Wavelength HPLC System can easily handle the requirements to detect and measure these types of explosive residue contaminants; for any military, industrial, forensic or research situation. The conditions for a specific type of analysis, as shown on the back, is just one of many methods available for this work. The wide assortment of analytical columns and solvents allow any specific condition to be optimized so the most accurate and precise data can be obtained.

Analyst: Gerald J. DeMenna, Ph.D.

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Method: Residue Analysis
Description: BLC-20 HPLC
Column: 25cm x 5mm C-18 / 5u
Sample: Test Chamber Wipes
Operator: Dr. Jerry DeMenna
Comments: Characterization of explosive charge residues vy Isocratic HPLC with UV at 220nm and RI; column heater at 450ºC, 1.5ml/min flow, IPA: MeOH: H2O [5:30:65]. Mobile phase at an upper pressure limit of 2000 PSI. Samples collected with EtOH / Me2CO / MeC12 on clean cotton swab from firing chamber, extracted into mobile phase for 50uL injection.

Number	Components	Retention	Area	External Units
1	Solvent	0.166	28877.422	45.48
2	Glycerol	3.333	124.328	0.20
3	EGDN	6.133	204.135	0.32
4	NG	7.400	165.421	0.26
5	HMX	8.350	1774.141	2.79
6	RDX	10.333	532.531	0.84
7	1-3 DNB	12.166	2475.434	3.90
8	TNT	13.700	26770.458	42.16
9	2/3/4-NT (mix)	15.516	1739.419	2.74
0	unknown	15.133	249.495	0.39
0	unknown	16.350	582.013	0.92

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