



Acclaim® Explosives Columns – Complete Solution for U.S. EPA Method 8330

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The highly toxic nature of explosive compounds, coupled with their persistence in the environment, has generated increasing environmental concerns. The U.S. Environment Protection Agency (EPA) regulates explosives and related compounds that are commonly found in the soils, groundwater, and sediments in and around army firing ranges, munitions plants, battlefields, and similar areas. EPA Method 8330 is intended for the trace analysis of explosives residues by HPLC using a UV detector. The method recommends the use of a C18 reversed-phase column as the primary column for separating 14 priority explosives compounds. Because some of these compounds coelute on C18 columns, a secondary column (e.g., a cyano packing) is required to confirm all positives observed on the C18 column. Because of the inadequate resolution power provided by existing stationary phases, analysis of explosives compounds using the EPA 8330 protocol is often a time-consuming task. The Acclaim Explosives E1 and E2 columns are reversed-phase columns that have been specifically designed to resolve all 14 explosives listed in EPA Method 8330. The novel, unique column chemistries provide superior resolution compared to existing columns for this application; the E1 and E2 columns have complementary selectivity (Figure 1).

Experimental

Acclaim Explosives E1 and E2 columns (4.6 × 250 mm, $d_p = 5$ mm, Dionex, Sunnyvale, CA, USA) were used for the separation. Separations were performed on a modular UltiMate™ 3000 HPLC System (Dionex, Sunnyvale, CA, USA) equipped with a LPG 3600 gradient pump, WPS-3000 Autosampler, TCC-3200 column oven, and VWD 3400. Chromeleon® 6.70 Chromatography Management Software (Dionex, Sunnyvale, CA, USA) was used for system control and data processing. The explosive standards were purchased from AccuStandard, Inc (New Haven, CT, USA).

Results and Discussion

The analysis of explosives residues by HPLC is usually performed on a C18 reversed-phase column as the primary column. Despite the fact that many C18 columns are available and have been used for explosives analysis, few are capable of baseline resolving all 14 explosives under the chromatographic conditions recommended by EPA Method 8330. Therefore, the current method requires confirmation of positives observed on the C18 column using a secondary column with complementary selectivity (e.g. a cyano column). However, due to severe peak overlapping on these columns, peak identification can still be ambiguous and the process is tedious. As shown in Figure 1, the Acclaim Explosives (E1 and E2) columns are the solution to this

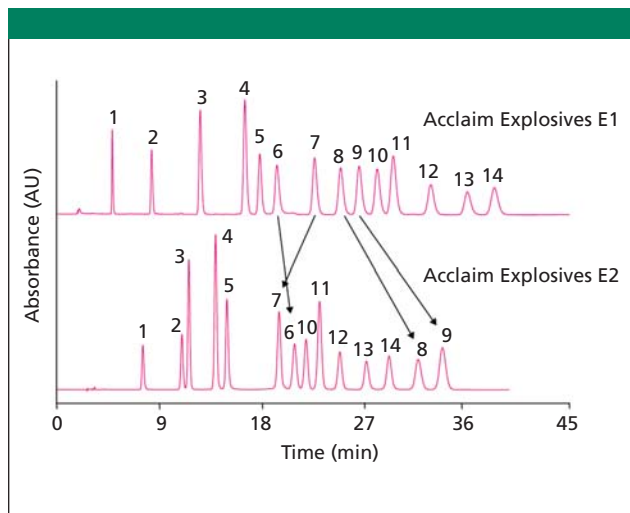


Figure 1: Baseline separation of 14 explosives listed in EPA method 8330. Mobile phase, methanol/D.I. H₂O (43:57 v/v for E1, 48:52 v/v for E2); flow rate, 1 mL/min; injection volume, 5 μ L; temperature, 30 °C; and detection, UV at 254 nm. Peaks (100 ppm each): (1) HMX; (2) RDX; (3) 1,3,5-TNB; (4) 1, 3-DNB; (5) NB; (6) Tetryl; (7) 2,4,6-TNT; (8) 4-Am-2,6-DNT; (9) 2-Am-4,6-DNT; (10) 2,6-DNT; (11) 2,4-DNT; (12) 2-NT; (13) 4-NT; (14) 3-NT.

long-lasting difficulty. Both columns provide baseline separation for all 14 analytes with excellent peak shape and efficiency using chromatographic conditions recommended by EPA 8330. The E1 and E2 columns exhibit different selectivities, which makes them a complete column suite for explosives analysis following EPA 8330 protocol.

Conclusion

Acclaim Explosives (E1 and E2) columns are a new family of high efficiency silica-based columns for explosives analysis. Both E1 and E2 columns provide baseline resolution of 14 target explosives listed in EPA Method 8330, but with different selectivities. Thus, the E1 column is an ideal direct replacement of the current primary column (C18), while the E2 column is an excellent alternative that not only can be used alone, but also serve as a confirmatory column for explosives analysis.

References

- (1) EPA Method 8330, U.S. government (1994).

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