

Identify and Quantify Adulterants in Seized Cocaine

Using GC/MS (Rtx[®]-440 Column) and HPLC/RI (Pinnacle II[™] Amino Column)

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- Low bleed Rtx[®]-440 column improves resolution and inertness for adulterants by GC/MS.
- GC/MS provides positive identification for all adulterants except sugars; data can be used as evidence.
- HPLC is the preferred chromatographic method for identifying sugars as adulterants.

Illicit cocaine is commonly “cut” with adulterants or diluents to increase the amount of product available for sale. Because the composition of an illicit cocaine mixture can be specific to one dealer, identification of adulterants and diluents in seized cocaine is critical in determining the possible routes of distribution and sales.

Either GC or HPLC can be used to identify cocaine adulterants such as sugars, anesthetics, analgesics, and stimulants. GC is the most common analytical technique used for analyzing all cocaine adulterants except sugars. Although sugars can be derivatized for analysis by GC, they are more easily detected using HPLC.

GC

Cocaine mixture components can be detected using flame ionization detection (FID, Figure 1), nitrogen-phosphorus detection (NPD), or mass spectrometry (MS). Although FID or NPD provide good sensitivity for the adulterants, GC/MS is the most widely accepted detection method. MS is very sensitive, provides positive identifications based on mass spectra, and MS data are accepted as confirming evidence in courts of law.

Among the column types we evaluated, only Rtx[®]440 columns resolved lidocaine and caffeine to baseline (Figure 1). To evaluate the columns, we prepared mock samples of illicit cocaine by adding equal concentrations of a variety of adulterants and diluents to cocaine hydrochloride. We used stimulants, including caffeine, local anesthetics, such as lidocaine, and over-the-counter analgesics, such as phenacetin, and followed a simple “dilute and shoot” sample preparation scheme to dissolve the samples for analysis.

We developed a GC/MS method that enabled us to identify each adulterant or diluent, focusing on maximizing resolution while minimizing total analysis time in order to increase sample throughput. In the optimized GC/MS method (Figure 2), total analysis time was 6.5 minutes. Unlike in the GC/FID analysis (Figure 1), caffeine and lidocaine were not resolved to baseline, but were resolved by approximately 40% (Figure 2), due to MS vacuum effects on sample flow through the column. Caffeine and lidocaine have very different mass spectra, however, and extracted ion analysis ensured

Figure 1 An Rtx[®]-440 column resolves lidocaine/caffeine, and other cocaine adulterants, to baseline.

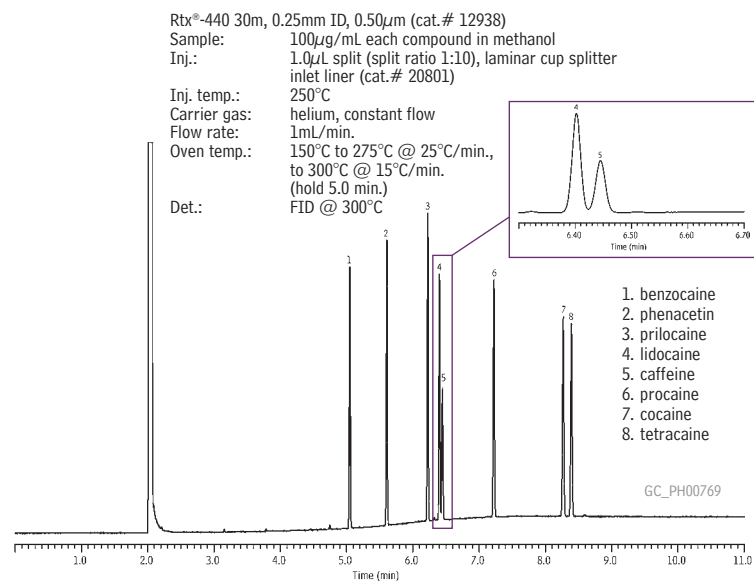


Figure 2 Analyze cocaine adulterants in 6.5 minutes, using an Rtx[®]-440 column in a GC/MS analysis.

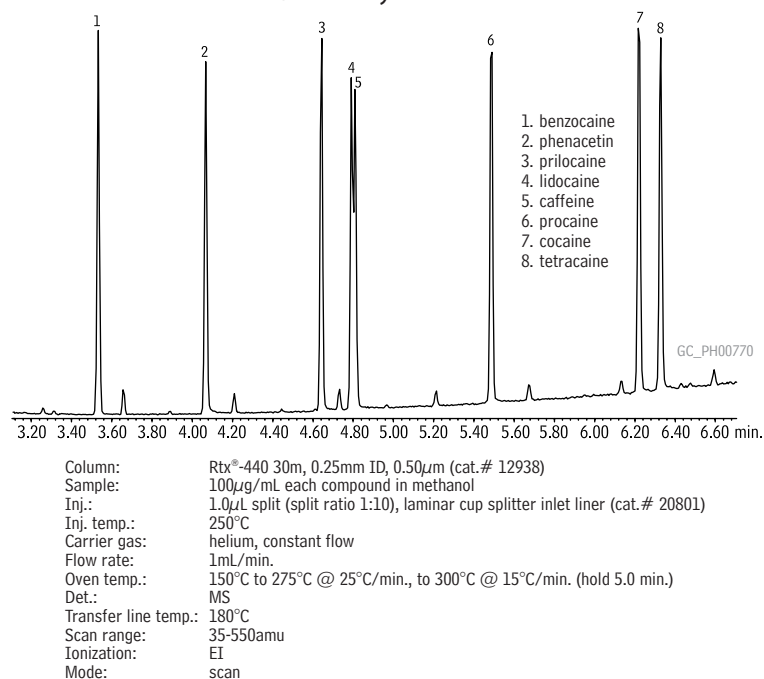
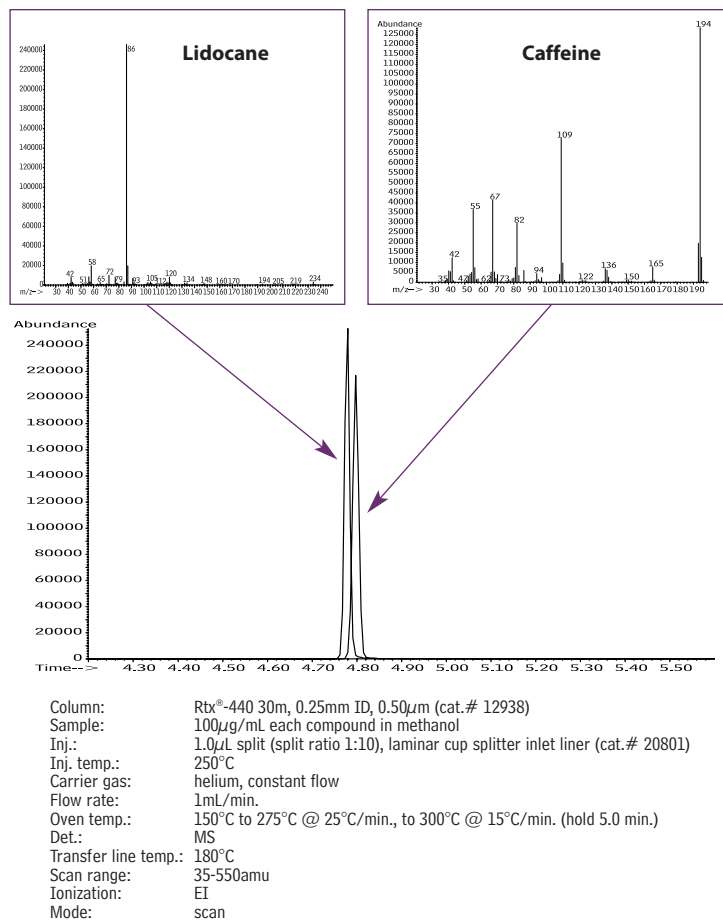


Figure 3 Distinctive mass fragments ensure positive identification of lidocaine and caffeine.



positive identification and allowed quantification of each compound. Lidocaine and caffeine have distinctive mass fragments of 86m/z and 194m/z, respectively (Figure 3).

HPLC

Sugars are not easily volatilized and, therefore, are difficult to analyze by GC, making HPLC the better chromatographic approach for this analysis. Further, refractive index (RI) or evaporative light-scattering (ELS) detection must be used because sugars have no UV chromophore. HPLC/RI or HPLC/ELS provides reproducible retention times, adequate peak identification and good quantification for sugars, as shown in Figure 4.

HPLC/MS methods for simultaneous analysis of cocaine, sugars, and other classes of adulterants and diluents have not yet been developed, but such methods would enable analysts to evaluate street cocaine mixtures in one analysis. Column parameters and mobile phase composition will be critical parameters to optimize.

Conclusions

Cocaine samples can be “fingerprinted” by identifying and quantifying the adulterants and diluents mixed with the drug. GC/MS provides adequate quantitative information about the concentration of each additive, relative to the cocaine concentration, and provides undisputable identification of a substance (retention time and mass spectrum data). Therefore, GC/MS is the preferred chromatographic method for analyzing cocaine and most cocaine adulterants. Sugars are best analyzed by HPLC.

for more information

Smith, F.P, *Handbook of Forensic Drug Analysis*, pp.235-275, Elsevier, 2005.

Telepchak, M.J., T.F. August, and G. Chaney, *Forensic and Clinical Applications of Solid Phase Extraction*, pp.204-213, Humana Press, 2004.

Rtx®-440 (fused silica)

(proprietary intermediate-polarity Crossbond® phase)

ID	df (µm)	temp. limits	length	cat. #
0.25mm	0.25	20°C to 320/340°C	30-Meter	12923
0.25mm	0.50	20°C to 320/340°C	30-Meter	12938

Pinnacle II™ Amino

3µm Particles, 4.6mm ID	cat. #
150mm	9217365

Carbohydrate HPLC Performance Check Mix

Dry components in 4mL screw-cap vial. Reconstitute in 1mL acetonitrile:water (75:25) to 2.0, 2.1, 4.4, 4.5, 4.0 mg/mL, respectively.

glucose	2.0mg	maltose	4.5
fructose	2.1	sucrose	4.0
lactose	4.4		
cat. # 31809 (ea.)			

No data pack available.

tech tip

We recommend using an HPLC guard column for this application. For Trident™ guard column systems, refer to our catalog, or visit our website at www.restek.com/hplc.

Figure 4 Pinnacle II™ Amino column provides fast, reliable analyses for sugars.

