

Instantaneous Detection of Illicit Drugs on Currency

The widespread presence of illicit drugs on currency is an indication of the extent of the worldwide substance abuse problem. Remarkably, cocaine can be found on virtually all one-dollar bills in the United States — the upper limit for the general background level of cocaine is estimated to be 13 ng per bill¹.

The Direct Analysis in Real Time (DART™) ion source, combined with the AccuTOF™ mass spectrometer can be used to sample drugs on currency within seconds. No sample preparation (extraction, wipes, etc.) or chromatography is required. The bill is placed in front of the DART and the presence of drugs can be detected immediately. Only a small portion of the bill is sampled at any given time. This allows the analyst to view the distribution of drugs on the surface of a bill, and allows the bill to be retained for reexamination at a later time.

Over the past few years, we have used DART to examine paper currency from the United States and other countries. Cocaine was found at various levels on almost all US one-dollar bills. Cocaine was detected in significant amounts on a Venezuelan 50 Bolivares bill and in large amounts on a Spanish 2000 peseta bill. New currency and larger-denomination US bills were much less likely to show the presence of cocaine and other drugs.



Figure 1 shows the presence of cocaine on a US one-dollar bill.

Cocaine is detected as $C_{17}H_{22}NO_4^+$ ($[M+H]^+$) at m/z 304.15488. The assignment of this peak as cocaine was confirmed by raising the orifice potential to induce fragmentation (not shown). The cocaine fragment ion $C_{10}H_{16}NO_2^+$ is observed at m/z 182.1182. Mass measurements for both $C_{17}H_{22}NO_4^+$ and $C_{10}H_{16}NO_2^+$ were within one millimass unit.



Other drugs detected on dollar bills include methylphenidate (Ritalin, figure 2) and procaine. Procaine is a local anesthetic used by drug dealers as a cocaine adulterant.

Substances commonly detected on US bills include nicotine, diethyltoluamide (DEET bug repellent), sunscreen, dioctylphthalate (plasticizer), triethanolamine (from cosmetics) and glycerol and other polyols. Triethanolamine ($[M+H]^+$, m/z 150.1130) is easily distinguished from the illicit drug methamphetamine ($[M+H]^+$, m/z 150.1283) by its exact mass.

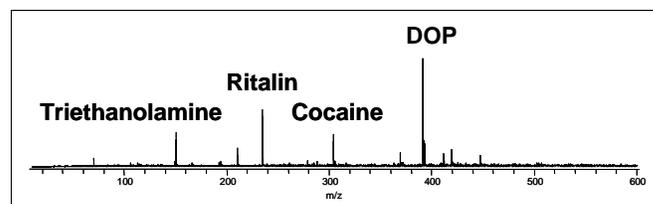
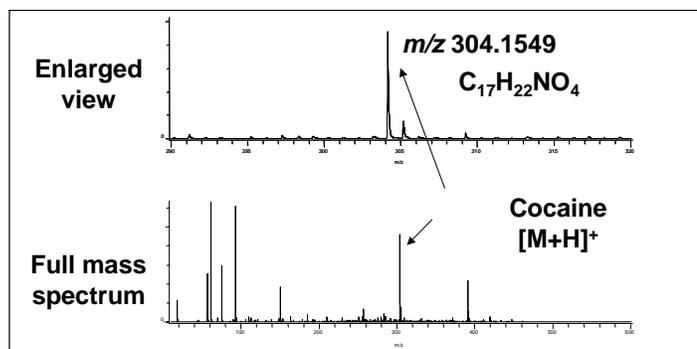


Figure 2. Ritalin and cocaine on a US \$1 bill. All compounds shown were detected as the $[M+H]^+$ and composition assignments were verified by exact mass measurements.

Figure 1. Cocaine on a US \$1 bill.

¹ Paradis, D. *RCMP Gas.* 1997, 59, 20-22