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Drugs of Abuse on Coated Paper and Polymer Currency

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short report

Drugs of Abuse on Coated Paper and Polymer Currency

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Abstract

Previous research has shown that cocaine contamination of bank notes is an international phenomenon. There are several hypothesized mechanisms by which cocaine is attracted to currency, based upon factors such as the fibers, pigments, and composition of the paper. Modern bank notes are made of several different substrates including polymers and coated papers. Acid-base extraction and GC-mass spectroscopy were used to extract and detect cocaine and other substances from Mexican 20 peso MXN (polymer) and Canadian $5 CAN (coated paper) bank notes taken from circulation.

Eighty percent of both polymer Mexican and coated paper Canadian bills tested positive for cocaine in agreement with results from testing paper US $1 bank notes. The results indicate that the bank note substrate is not the primary factor in determining cocaine attraction for currency. Dibutyl phthalate, a plasticizer, and (1-hydroxycyclohexyl)phenyl-methanone, a photoinitiator, were detected on all of the Canadian bills. Other interesting results for the Canadian bills include the presence of acetaminophen on 30%, caffeine on 35%, and nicotine on 80%.

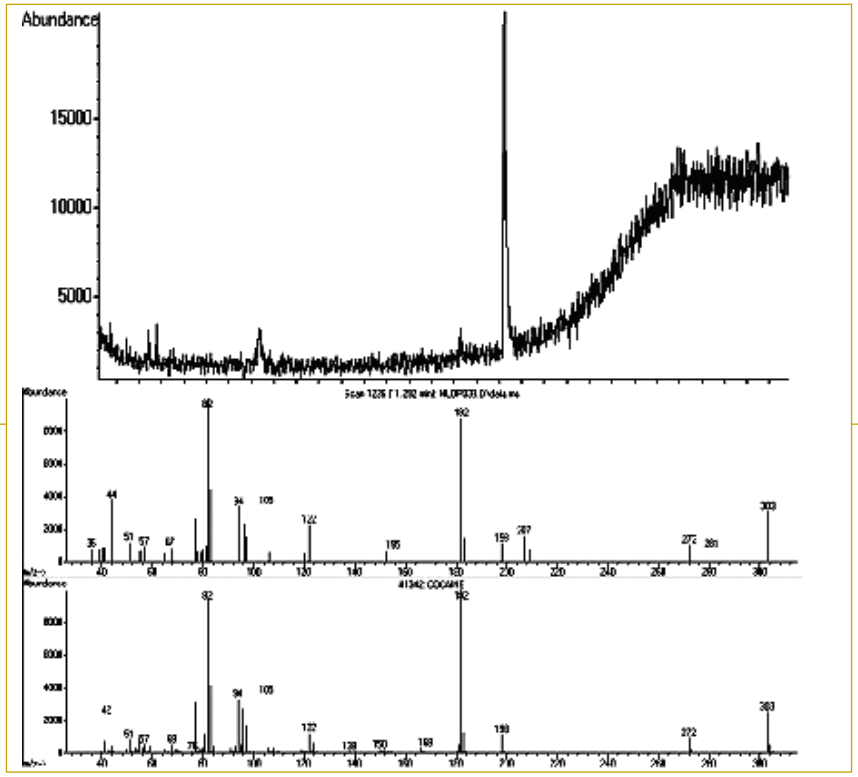
Introduction

Stanford Angelos of the Chicago Office of the Drug Enforcement Administration (DEA) conducted one of the earliest studies of cocaine contamination on currency in the mid 1980s. He found that a third of randomly selected US bank notes were contaminated with cocaine and that the source of the contamination may have been currency sorting machines in use at Federal Reserve Banks. In 1989, the cocaine contamination of bank notes obtained from the Bank of Canada in Regina, Saskatchewan was compared to case samples seized from suspected drug dealers. The case sample contamination was 50 to 1000 times higher than the background contamination of 10 ng/note. Since then, cocaine contamination has been found on bank notes worldwide. The tendency for cocaine to adhere to bank notes has been attributed to the affinity of the cocaine crystals for the cotton fibers used in paper money, the inks used in the printing process, and the oils and grease residues left behind during handling.

The objective of this study was to use acid/base extraction to determine if the bank note substrate is the primary factor in the affinity of cocaine for currency. The contamination of paper bank notes, such as the US dollar, is well established. The notes tested were Canadian coated paper $5 bills and Mexican polymer 20 peso bills. At the time of these experiments, the 20 peso note was the only Mexican polymer bill in circulation. The remaining denominations were still paper. In addition, the results of testing Mexican polymer currency for the presence of cocaine is being reported for the first time.

Materials and Methods

Twenty circulated bills of each denomination ($5 CAN and 20 peso MXN) were obtained. The serial number, print year, and condition of each bill was recorded. Bills were crumpled, exposing as much of each face as possible, and placed in a 20mL vial. Then, 10mL of 0.1M HCl was added to the vials. Samples were placed on an orbital shaker overnight. The aqueous extract of each sample was analyzed using acid-base extraction. First, 0.5M NaOH was added dropwise until the pH of the solution was greater than 12. After 1mL of chloroform was added to each vial, they were agitated and allowed to sit for 30 minutes. This organic layer was then



MS results for cocaine on a 20 peso MXN bill.

Figure 1: This is consistent with previous experiments.

removed and injected into a Gas Chromatography/Mass Spectrometer (GC-MS) for analysis. In some cases, it was necessary to centrifuge the vial contents due to a large amount of precipitate in the solution.

Results and Discussion

MXN pesos:

Eighty percent of MXN pesos tested were found to be positive for cocaine. GC retention times were within ± 0.05 minutes of the standard, and the MS peaks of 82, 182, and 303 also matched the control and the NIST library record for cocaine. The retention time and mass spectra give a positive identification of cocaine.

CAN Dollars:

Analysis of Canadian $5 CAN bills resulted in the positive identification of cocaine on 80% of bills tested. In addition, several other peaks (Fig. 2) were analyzed and the mass spectra were indicative of nicotine on 80% of the bills, caffeine on 35%, and acetaminophen on 30%. Components of the coating on paper bills were also found on all the CAN samples. These were identified as dibutyl phthalate, a plasticizer, and (1-hydroxycyclohexyl)phenyl-methanone (HPM), a photoinitiator. Positive controls were not used to confirm the identification of nicotine, caffeine, acetaminophen, dibutyl phthalate, or HPM, but presumptive identifications were made by mass spectral analysis.

	MS Peaks: m/z	Retention time: min
Cocaine	82, 182, 303	8.515
Nicotine	84, 133, 161	6.420
Caffeine	194, 109, 55	9.078
Acetaminophen	109, 151, 80	5.622
Dibutyl phthalate	149, 76, 104	7.226
HPM	99,81,105	6.658

Table 1: Primary Mass Spectra Peaks and Retention Times

Another area of interest is the potential damage done to a bill by the acidic extraction. Microscopic observation showed only minor damage to the Mexican and Canadian bills, but it appeared that there was significant damage to a security element of the Canadian bills (Fig. 3).

The results of this study suggest that binding affinity of cocaine to currency is not related to bank note composition or coating. Further analysis of the Canadian bank notes demonstrated that it is also possible for substances other than narcotics to bind to the same substrates. However, it is necessary that further studies be carried out involving bank notes from more countries, using larger sample sizes. Additional studies must also be conducted to determine cocaine's affinity for binding to different substrates, as well as to understand what factors influence this binding.

Figure 2: GC analysis and product distribution of $5 CAN bills

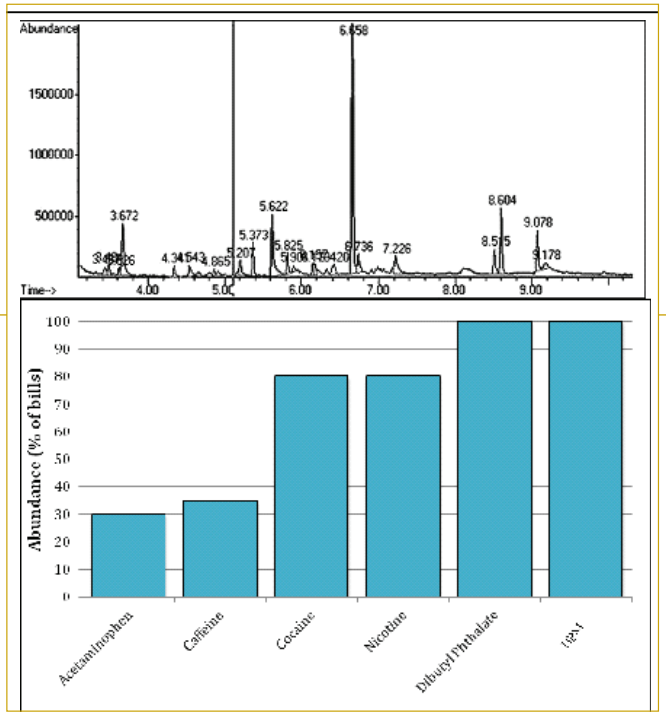
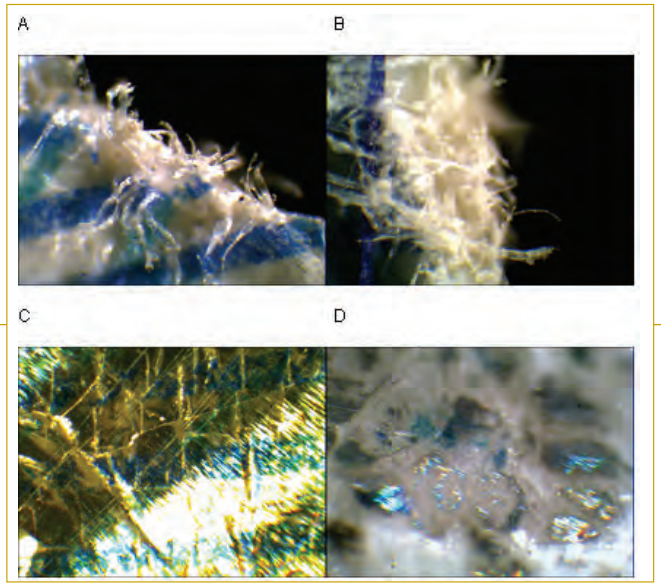


Figure 3: Microscopic observation of $5 CAN bill before and after acid-base extraction. (A-B) A torn corner before and after extraction. (C-D) A reflective security element before and after extraction.



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