Detecting Black Cocaine Using Various Presumptive Drug Tests

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ABSTRACT: The Canada Border Services Agency (CBSA) recently intercepted a shipment of black cocaine containing several exhibits, which were sent to the Science and Engineering Directorate (S&E Lab) for analysis. The CBSA S&E Lab determined that various presumptive drug tests, such as immunoassay tests and ion mobility spectrometry, can be used as screening tools to determine which exhibits of the shipment should be further analyzed using laboratory instrumentation having greater potential discriminating power to confirm the presence of cocaine in the samples.

KEYWORDS: cocaine, IMS, black cocaine, drug test, trace detection, immunoassay, forensic chemistry.

The disguising of illicit materials to facilitate their trafficking is not something new; narcotics are no exception. Drug smugglers, for example, have been very active at finding new ways of modifying and/or masking various drugs to avoid their detection. Such an example is black cocaine, which is a mixture of cocaine base and/or cocaine hydrochloride with other substances carefully chosen to specifically hide the physical characteristics of the cocaine and interfere with its detection [1-5]. Once the black cocaine reaches its destination, it must then be treated chemically in order to extract the cocaine from the mixture. Several seizures of black cocaine have been made around the world, which include: religious icons made of black cocaine [6], black cocaine as a dark solid hidden in items such as a hammock [7], black cocaine as a powder in toner cartridges [8,9], as an industrial dye [10], and as an ingredient in plastic materials [11-13].

The Canada Border Services Agency (CBSA) recently submitted several exhibits of black cocaine to the CBSA's Science and Engineering Directorate (S&E Lab). During the analysis of the black cocaine exhibits, the S&E Lab used the various commercially available narcotics field test kits and immunoassay drug tests in our possession at the time of the seizure, as well as, ion mobility spectrometry (IMS) as screening tools. It was the goal of the S&E Lab to determine which presumptive tests could be used to identify cocaine in black cocaine samples. Please note that this study is limited to the S&E Lab's inventory of equipment and tests at the time of the seizure and is not intended to serve as a promotion tool for the equipment and tests used.

Figure 1 - Black granular material containing cocaine.

Experimental, Results, and Discussion

Details of the seizure

The S&E Lab recently received exhibits containing black granular material that was similar to crushed coal (Figure 1). The exhibits were taken from bags each weighing 20 kilograms, declared as asphalt product. The bags of asphalt were seized at a Canadian international airport and originated in Colombia.

The samples were first analysed using IMS which gave a strong positive result for cocaine in 25% of the exhibits. All of the samples were also analysed using immunoassay drug tests; while only the samples containing cocaine were tested using narcotics test kits. A more thorough analysis of the samples followed using GC/MS, LC/MS, and FTIR. The analyses indicated that the samples were composed of a hydrocarbon containing material and that 25% of the samples also contained cocaine. In addition, the analyses indicated the presence of phenyltetrahydroimidazothiazole in most of the cocaine containing exhibits. The cocaine containing exhibits were found to contain approximately 4% (w/w) cocaine calculated as the hydrochloride. The total quantity of cocaine in this shipment was determined to be 10 kg, which has an estimated resale value of $1,250,000 CAD.

Presumptive drug testing

The presumptive drug tests that were performed consisted of IMS, narcotic test kits (the Narcopouch from ODV Inc. and the Narcotic Identification Kit polytesting systems, also called the NIK tests), and lateral flow immunoassay-based narcotics identification tests. For this study, the lateral flow immunoassay-based narcotics identification tests used were the Rapid Solids tests from Cozart® Bioscience and the DrugID® tests from Securetec (two various types were evaluated: single test for cocaine and multiple tests for cocaine, opium, amphetamine and methamphetamine - Coc/Opi/Amph/Meth).

Figure 2 - Cozart® cocaine solids test: **(a)** Positive test for cocaine, **(b)** Negative test for cocaine.

Cozart® cocaine solids test

Following the manufacturer's general procedure for powders, a swab was used to pick up a small amount of the powder which was then placed in the buffer solution provided with the test. The lid was then screwed on the bottle of buffer, and the bottle was shaken gently for 5 sec. Four drops of the buffer solution were then squeezed in the sample well of the cartridge. After approximately 2 min, or once the liquid had reached the end of the cartridge and the control line appeared, the result could then be interpreted. Results were positive for the samples that were known to contain cocaine and negative for the other samples (Figure 2).

DrugID cocaine

Using the manufacturer's general procedure for powders, a spatula was used to pick up a small amount of sample. The spatula was then placed in the provided buffer solution and stirred for 5 sec. The Drug ID test stick was then dipped into the buffer solution for 15 sec and placed on a horizontal surface for 3 min. Both the DrugID single drug and multi drug test sticks gave positive results for the samples containing cocaine and a negative result for samples that did not contain cocaine (Figures 3 and 4). All samples gave a negative result for opium, amphetamine, and methamphetamine on the multitest DrugID test stick.

NIK tests

The NIK tests were only performed on the samples containing cocaine. The sample was first treated as an unknown and the manufacturer's general poly-testing procedures were followed. First, test A - Marquis Reagent - was performed and resulted in no obvious color change when looking at the supernatant exclusively (see Figure 5a). Using the Marquis Reagent test, cocaine can give a buff, light peach color, or no color. The next step was then to proceed to test G - Scott Reagent - for cocaine. There was no color change observed, the supernatant remained pink and the powder remained black (Figure 5b). A blue color would develop in the presence of cocaine salts; in the case of cocaine base, only the material will turn blue. The test G was repeated with more material and again, no color change could be seen, indicating a negative result. Based on the described results, the NIK Polytesting system is not able to detect cocaine in samples of black cocaine.

Narcopouch®

The tests were only performed on the samples containing cocaine. The general procedure was followed; as such, test #901 - Mayer's reagent - was performed and resulted in no color change (negative result). This was not the expected result for cocaine, which should give a creamy white result. Despite the previous result, test #904 - for Cocaine HCl, free-base, or "crack" was performed. The reaction between the black powder and the content of the left ampoule of the pouch did not lead to a color change; the solution remained pink, which is a negative result for cocaine. Given the results described above, the Narcopouch® tests are not able to identify cocaine in samples of black cocaine.

Ion Mobility Spectrometry

The samples were analysed on various models of ion mobility spectrometers in our possession at the time of the seizure. Samples were run on four instruments from two different manufacturers - three bench top models (Itemiser^{3}® from Morpho Detection, Ionscan® 400B, and Ionscan® 500DT from Smiths Detection) and one handheld unit (the multi-mode

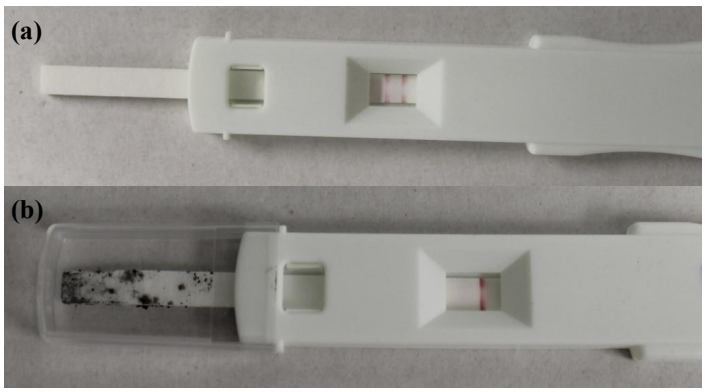

Figure 3 - Drug ID test stick: **(a)** Positive test for cocaine, **(b)** Negative test for cocaine.

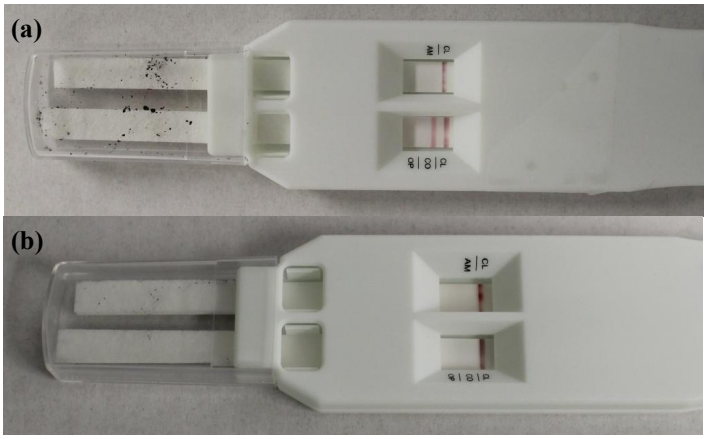

Figure 4 - DrugID Coc/Opi/Amph/Meth test stick: **(a)** Positive test for cocaine. **(b)** Negative test for cocaine.

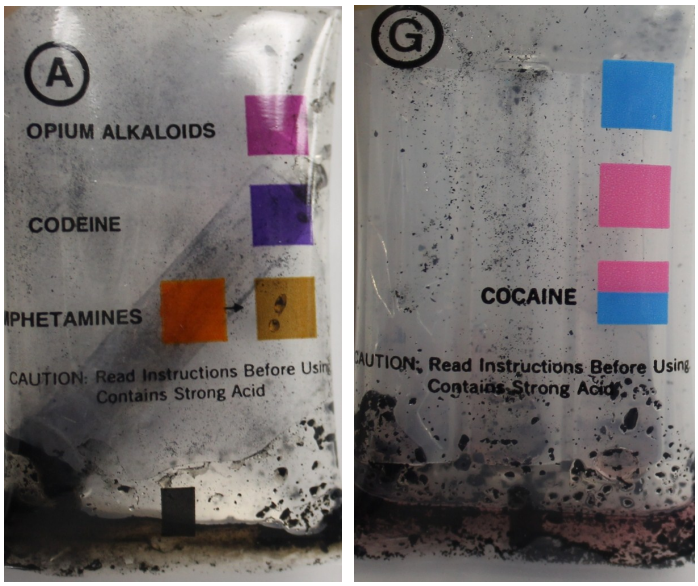

Figure 5 - Picture of test A - Marquis Reagent for one sample containing cocaine. Picture of test G - Scott Reagent for one sample containing cocaine, only the left (first) ampoule was broken.

threat detector, MMTD, also from Smiths Detection). All four instruments were set to standard parameters and conditions for narcotics detection. The sampling was performed using a teasing needle which was placed in the sample bag and rubbed against the black powder, the excess material on the needle was removed by shaking the needle, and the residual powder on the needle was then transferred to the appropriate sampling material for the equipment used. All four instruments sucessfully identified cocaine in the samples that contained cocaine and none gave a false positive for the samples that did not contain cocaine. Examples of plasmagrams (from the Ionscan 400B instrument) obtained for a sample containing cocaine and for a sample not containing cocaine are presented in Figures 6 and 7, respectively. The plasmagram in Figure 6 shows three peaks, one corresponding to the calibrant peak at a drift time of 9.588 msec (K_0 1.8566), one corresponding to the cocaine peak at a drift time of 15.345 msec (K_0 1.1600) and one unidentified compound coming from the sample at 12.214 msec. The plasmagram in Figure 7 only shows the calibrant peak.

Conclusions

Although efficient on solid samples, colorimetric tests such as the NIK tests and Narcopouch® have been known to present challenges when colored solids samples are tested, as the sample color may obscure the resulting color of these tests. The negative results obtained when using these colorimetric tests on the black solid samples in this study were not surprising. It is unclear if the negative results are due to the difficulty in seeing the change of color due to the black coloration of the solution or if the complex matrix is interfering and preventing the reactions of the tests with the cocaine in the sample to occur.

The other presumptive tests were efficient in the identification of cocaine, despite the complexity of the sample matrix. The lateral flow immunoassay-based narcotics identification tests required a simple sample preparation and

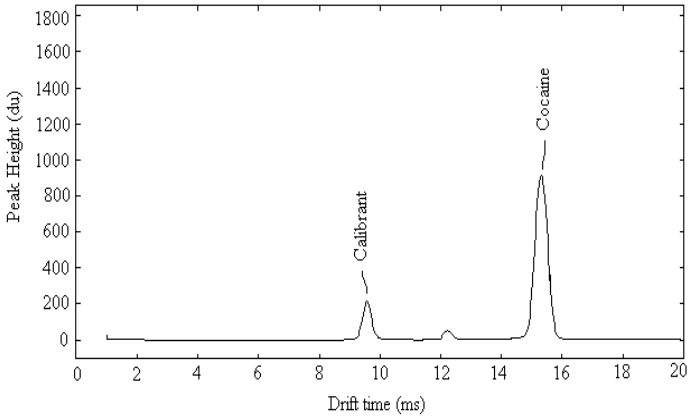

Figure 6 - Plasmagram of a sample containing cocaine.

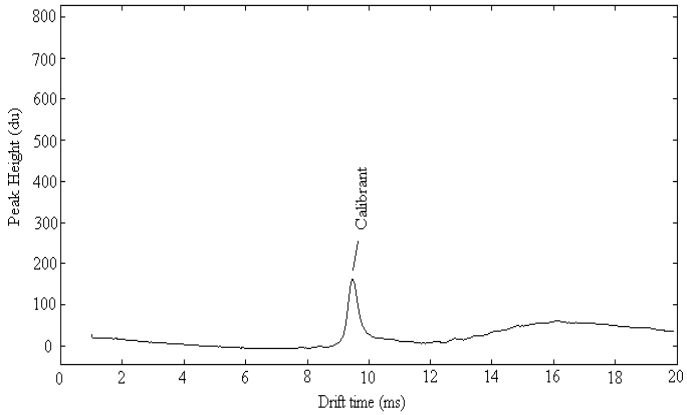

Figure 7 - Plasmagram of a sample not containing cocaine.

provided the results in less than five minutes. As for the ion mobility spectrometry analysis, results were obtained in a few seconds and no sample preparation was required.

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