

Sniffing out billions in US currency smuggled across the border to Mexico

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Criminals are smuggling an estimated \$30 billion in U.S. currency into Mexico each year from the United States, but help could be on the way for border guards, researchers will report here today. The answer to the problem: a portable device that identifies specific vapors given off by U.S. paper money. They will present the new research at the 248th National Meeting & Exposition of the American Chemical Society (ACS).

In the past fiscal year, law enforcement officials say they uncovered more than \$106 million in smuggled cash headed from the U.S. to Mexico. But this was only a small portion of the billions that made it across the border undetected—hidden among belongings, in clothing or elsewhere. The bulk of that currency is laundered drug money. Travelers crossing the U.S./Mexico border are required to report cash or endorsed checks over \$10,000. If they don't declare larger sums, the money that is found can be seized.

"We're developing a device that mimics the function of trained dogs 'sniffing' out concealed money, but without the drawbacks, such as expensive training, sophisticated operators, down time and communication limitations," says Suiqiong Li, Ph.D., a member of the research team. "The system would extract gas samples from the traveler or from bags, vehicles and shipping containers. It would detect the trace currency emission signature even in the presence of car exhaust, perfumes, food and a range of temperatures, atmospheric pressures and relative humidity."

Li says the technique, known as the Bulk Currency Detection System (BCDS), should work effectively within the seconds or few minutes it takes for border inspections. It involves gas chromatography/mass spectrometry (GC/MS), a widely used analytical technique. Experts already use this method for analyzing vapors to detect drugs and explosives, as well as to investigate the causes of fires and identify unknown compounds. But the current way to uncover smuggled money depends on checks by guards or trained dogs, without the benefit of any devices, according to Li.

The BCDS is being designed to find the emissions signature of the currency despite the presence of strong background gases and contaminants. It would be an automated, hidden-money screening system, using GC/MS plus solid-phase microextraction and a thermal desorption technique. BCDS would automatically extract, preconcentrate and analyze the gases, Li explains.

When developing the device, the researchers first had to figure out which gases money emits and how fast that happens. It turned out that the gases are a set of trace chemicals, including aldehydes, furans and organic acids.

"We have found that U.S. currency emits a wide range of volatile organic compounds that make up a possible 'fingerprint' that we can identify in less than a minute," explains Joseph Stetter, Ph.D., principal investigator for the study. He and Li are with KWJ Engineering, Inc. This is the first report of the feasibility of sampling emission rates with a practical, money-detecting device, he says. To capture the gases, which are specific to U.S. paper money, guards would pass a probe over clothing or into baggage. If the probe detects a high intensity of the gases, it will indicate that a large amount of [money](#) likely is present, he says.

The researchers say the device should lead to a significant improvement in detecting smuggled currency and have a strong economic impact for the United States. Stetter estimated that it would take from two to three years to develop the device for use by border guards.

More information: Title: Evaluation of SPME-GC/MS approach for developing clandestine bulk currency detection system

Abstract

Bulk cash smuggling is a serious issue in recent years. It is estimated that \$6–36B flow illegally between the United States and Mexico each year during otherwise legitimate border crossings. A nondestructive bulk currency detection system (BCDS) for screening pedestrians, vehicles and shipping containers will significantly improve boarder security, protect domestic economics and deter criminal and terrorist activity. However, such a practical device is not yet available because neither the target detection technique nor the instrumentation has been defined. In this paper, we evaluated the currency characteristics that provide a basis for detection, relevant physical/chemical instrumental approaches, and a rationale for selection of an approach to build a practical BCDS. US currency releases volatile compounds. These emissions can be used as a chemical signature in currency detection. The literature regarding characterization of volatile compounds associated with US currency is limited. To identify the unique vapor signature of US currency, we analyzed VOC emission from currency bills using thermal desorption GC/MS. This enabled calculation of emission rates of volatile compounds. The results were in agreement with prior studies of currency emissions. From our data and the literature, we determined a tentative fingerprint that represents currency, among the complex background present in real currency. The analysis shows that a most-likely US currency vapor signature contains a set of aldehydes, furans, and organic acids, at very low concentrations (1-70 ppb). A successful practical BCDS based on volatiles must be able to accurately identify and quantify

a speciated set of trace chemicals from a complex and highly variable matrix. Variations of GC/MS with SPME preconcentration have been identified as promising methods. Future developments will address optimization to meet the need for rapid sampling, speciation by fast GC or other separation method, and selected ion mass detection for selectivity and sensitivity.

Provided by American Chemical Society

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