B136 Detection of Narcotics and Organic Explosives Using Volatile and Semi-Volatile Chemical Markers

Jeannette M. Perr, PhD, Drug Enforcement Administration, Southeast Laboratory, 5205 NW 84th Avenue, Miami, FL 33166; and José R. Almirall, MS, PhD, Florida International University, Department of Chemistry and Biochemistry - IFRI, 11200 SW 8th Street, CP 316, Miami, FL 33199*

The goal of this presentation is to describe the analysis of volatile and semi-volatile chemical marker compounds for the detection and pre- sumptive identification of narcotics and explosives by Solid Phase MicroExtraction Ion Mobility Spectrometry (SPME-IMS).

Locating narcotics in a search or seizure situation or detection of illicit explosives before detonation is problematic due to the intentional con- cealment of these substances and their unique chemical properties. To date, the most effective means of locating contraband material has been the detection canine teams. It is believed that the canine is using volatile and semi-volatile chemical marker compounds to locate contraband material. Some of these volatile and semi-volatile compounds have been identified in the headspace of narcotics and explosives through canine detection team research. Detection of these compounds by an instrument but in a manner similar to that of a canine detection team will impact the forensic com- munity and/or humanity by allowing a well understood method supported scientifically into the courts assuring probable cause.

Solid Phase MicroExtraction (SPME) provides improvements over other sample extraction and pre-concentration methods due to commercial availability, selectivity, field portability, cost, ease of use, rapid and solvent free extractions. Ion mobility spectrometry (IMS) affords a sensitive, low cost, rapid, and portable method for presumptive analysis of organic mate- rials, such as narcotics and explosives. These spectrometers have become widely used in the nation's ports of entry and in presumptive search and seizure situations. The installed base of ~10,000 IMS conducts over 10,000,000 analyses each year. These devices are currently employed as particle samplers and do not use a sample pre-concentration technique. SPME was recently coupled to IMS through an adjustable temperature flow controlled interface. This interface successfully converted the IMS particle sampler into a vapor sampler and allowed for sample extraction and pre-concentration. Vapor sampling is important because it offers improved sensitivity and may allow for stand-off detection. Conversion of the widely used IMS particle sampler into a vapor sampler though an accessory would update the current infrastructure without significantly increasing cost.

Locating narcotics in a search or seizure situation or detection of illicit explosives before detonation is problematic due to the intentional con- cealment of these substances and their unique chemical properties. To date, the most effective means of locating contraband material has been the detection canine teams. It is believed that the canine is using volatile and semi-volatile compounds to locate contraband material. Some of these volatile and semi-volatile compounds have been identified in the headspace of narcotics and explosives through canine detection team research. For example, the following compounds have been identified in the headspace of explosives: 2-ethyl-1-hexanol (2-E-1-hexanol), cyclohexanone, 2-nitro- phenylamine (2-NPA), dinitrophenylamine (DPA), R-(+)-limonene, and 1,3-diethyl-1,3-diphenylurea (1,3-DE-1,3-DPU). Detection taggants are required components in United States manufactured or imported plastic explosives. Detection taggants exist in the headspace of explosives and can be used for trace chemical detection of explosives in addition to these com- pounds. Canines have many advantages but development of an instru- mental technique would allow for use in hazardous situations, increase duty time, and facilitate remote detection.

IMS is normally operated in positive ion mode for drugs of abuse and negative ion mode for explosives. The operation parameters were opti- mized for detection of the volatile and semi-volatile chemical markers instead of the narcotic or explosive parent compounds. For example, detection of the common taggant 2,3-dimethyl-2,3-dinitrobutane (DMNB) requires alteration of the standard operating conditions. SPME-IMS has been successfully used for the detection of these compounds at concen- tration levels expected to produce an alert for concealed drugs or explosives in an enclosed space such as the cargo hold of an airplane. The application of this patented and novel approach to drugs and explosives detection is presented.

Narcotics, Explosives, SPME-IMS

 ** Presenting Author*