## B22 Laboratory and Field Experiments Used for the Determination of Odor Signature Chemicals in Marijuana

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The goal of this presentation is to provide information to the forensic and law enforcement community regarding odor detection of marijuana by detector canines using SPME GC/MS analysis.

This presentation will impact the forensic community by confirming and identifying the chemical odorants of marijuana used in odor detection by canines

Marijuana products constitute the most widely used group of illicit drugs. Research on marijuana and its psychoactive properties began over a century ago, however there has been limited research into the chemical odorants that contribute to its unique odor. Odor detection of controlled substances including marijuana and cocaine has recently become a significant area of research because of their importance to the forensic, law enforcement and legal communities. Narcotic odor is a result of odorant(s), which is/are characteristic of a drug and detected by the olfactory receptors. Research has determined that certified law enforcement detector canines often do not alert to the parent drug itself, rather they alert to by-products or decomposition products. These products have been shown to be volatile organic compounds (VOCs) used by detection canines to locate controlled substances. Despite other methods for the detection of narcotic odor, the use of canines remains widely accepted as the most reliable and cost effective method of detection. Research into the odorants of cocaine and MDMA has shown methyl benzoate and piperanol respectively to be responsible for detected odors by the majority of law enforcement canines tested. This study presents the VOCs emanating from marijuana products under variable conditions in addition to the differences in odor perception of canines based on sample size, and length of exposure.

Solid phase micro extraction (SPME) combined with gas chromatography/mass spectrometry (GC/MS) was utilized to extract the VOCs from the headspace of marijuana and cocaine. Headspace SPME sampling makes it possible to obtain consistent samples of VOCs above very small quantities of drugs as well as very large samples. The odor chemicals present in the headspace of marijuana were compared with those extracted from other plant materials in addition to paper currencies. Sampling was done employing variable sample sizes, exposure and equilibrium times in addition to containment scenarios ranging from completely closed to completely open. The SPME GC/MS method utilized a 70µm Stable Flex™ Carbowax Divinylbenzene (CW/DVB) SPME fiber (Supelco). Carbowax Divinylbenzene has been proven effective in removing volatiles from the headspace of illicit drugs. Quantification of the volatiles extracted from the headspace of the marijuana products were evaluated and are presented.

The purpose of this research is to identify and quantify the significance of drug odorants which could potentially generate an alert by a detection canine. The illicit drugs involved in this study included marijuana and cocaine. The active odor signature chemical of cocaine has been confirmed to be methyl benzoate with threshold levels of 1-10µg spiked methyl benzoate or 0.1-1ng/sec-odor diffusion. The level of odor signature chemicals needed to initiate consistent alerts from law enforcement detector canines further enhances the significance of dog alerts to possible controlled substances, because these levels are only found if substantial quantities are present. The threshold levels of the potential odor chemicals will be investigated to further justify this statement.

Research has determined the highest composition of VOCs present in the headspace of marijuana to include α-Pinene, Limonene, β-Pinene, Carene, α-caryophyllene, β-myrcene and Caryophyllene. There is significant interest in determining the exact composition of the dominant chemical odorants in addition to their relative abundances based on sample size. Quantification of parent drug residues and drug odorants has also been evaluated for different paper currencies (U.S. and Jamaican). α-Pinene and limonene have been observed above the headspace of non-controlled plant materials as well as paper currency.

Results from these experimentations demonstrate that sampling time, size and degree of containment can have an influence on the ratio of VOCs observed. Field experiments, to determine canine interest in the observed chemical odorants were conducted. This research has not detected significant drug odorants above paper currency in general circulation verifying that there is insufficient drug contamination on paper currency in circulation to initiate an alert by a properly trained law enforcement detector dog. Field testing is under way to determine the dominant odorants which may include β-Pinene, α-caryophyllene, β- myrcene and Caryophyllene.

**Marijuana, Canine, Odor Detection**

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