

MEMORANDUM

TO: Dan Ziarkowski, Chief
Drug Lab Remediation & Time Critical Removal Unit

FROM: Angela A. Singh, Hazardous Substances Scientist

DATE: February 2, 2004

SUBJECT: PRELIMINARY ANALYSIS OF THE EFFICACY OF USING
CLEANING PRODUCTS TO BREAK DOWN
METHAMPHETAMINE.

After conducting a comprehensive nation-wide survey on remediation procedures of former methamphetamine laboratories, it came to our attention that most decontamination was being done using common commercial household cleaning solvents. In particular, bleach (sodium hypochlorite) was used to decontaminate and/or inactivate surfaces as part of the remediation process. For this reason we attempted to analyze the ability of bleach and other commonly used commercial cleaning detergents/solvents to chemically breakdown methamphetamine. Common solvents used for decontamination included baking soda, TSP-type detergents and household bleach.

This preliminary study was qualitative in nature and intended to identify the general effectiveness of cleaning agents towards breaking down or digesting methamphetamine. This analysis was based on the ability to detect street-grade methamphetamine and associated diluents after exposure to different cleaning agents using gas chromatography/mass spectrometry (GC/MS) for a qualitative assay. The assay could also detect by-products that may have been produced.

Materials

Two grams of street dosage methamphetamine HCL provided by the California Department of Justice, Bureau of Forensic Services was diluted in 1000 milliliters of distilled water using volumetric flasks. This standard solution was homogenized and allowed to sit for at least one hour. Subsequently, this standard solution was analyzed via GC/MS to qualitatively assay methamphetamine and its impurities. The street dosage methamphetamine was not measured for purity in itself, but was known to be cut with dimethylsulfone (DMSO₂). The analysis revealed that methamphetamine and low levels of DMSO₂ were present in this standard mixture. Due to resource limitations, the DMSO₂ found in the street grade methamphetamine was used as a relative indicator similar to that of an internal standard. DMSO₂ is fairly oxidized and the

oxidative properties of any of the cleaning agents were not expected to impact the DMSO₂ concentration.

Reagents and Chemicals

The following cleaning agents were used to conduct the research: Septi-Zyme, Clorox Bleach®, Crystal Simple Green®, Pine Sol®, Liqui Nox®, TSP detergent, and Arm and Hammer® baking soda. Chloroform and hexanes purchased from Spectrum Chemical were spectrophotometric grade. Methanol purchased from Fisher Scientific was high performance liquid chromatographic grade.

GC-MS

GC/MS analysis was performed on a Hewlett-Packard 6890 GC equipped with an HP-1, methyl siloxane (15m) capillary column using helium gas (provided by Air Gas) as the carrier gas.

Methods

Initial Testing

A 50ml aliquot of the standard methamphetamine solution was added to 50mls of the cleaning solvents and agitated with a magnetic stirrer bar overnight. Subsequently, a three milliliter aliquot was taken. To this aliquot, one milliliter of chloroform and three drops of concentrated sodium hydroxide were added and mixed thoroughly. The chloroform extracts were then injected into the GC/MS for analysis.

Most cleaning solvents did not have a measurable impact on the observed concentrations of methamphetamine. The Ultra Clorox Bleach® (6.15% sodium hypochlorite) appeared to have resulted in significant breakdown of methamphetamine. Four of the six cleaning solvents, including Ultra Clorox Bleach®, produced unknown by-products when mixed with the street-grade methamphetamine. These unknown by-products are most likely associated with unknown components of the street-grade methamphetamine, but not methamphetamine itself (Table 1). Results of this qualitative analysis indicated that the Ultra Clorox Breach® warranted further evaluation.

Table1. Results of the GC/MS analysis after the Methamphetamine solution and cleaning solvents were added:

Cleaning Solvents	Breakdown of Methamphetamine	By- Products Produced
Septi-Zyme	No Breakdown	Produced unknown by-products
Ultra Clorox Bleach®	90% Breakdown	Produced unknown by-products
Crystal Simple Green®	No Breakdown	Produced unknown by-products
Pine Sol®	No Breakdown	Produced unknown by-products
Liqui-Nox®	No Breakdown	No by-products produced
TSP detergent	No Breakdown	No by-products produced

Additional Testing to Further Evaluate Bleach

For further evaluation, an additional 25 mls of Ultra Clorox Bleach® was added to 25 mls of the methamphetamine/Ultra Clorox Bleach® solution that was previously analyzed. A three milliliter aliquot of the new solution was taken and mixed with one milliliter of chloroform and one milliliter of concentrated sodium hydroxide. The bottom separation layer was extracted and injected into the GC/MS for analysis.

The results of this bleach/methamphetamine analysis indicated that no detectable amount of methamphetamine was present. The analysis also indicated that there was no presence of by-products. However, it was not clear how Ultra Clorox Bleach® reacted with methamphetamine. Sodium hypochlorite (bleach) has some oxidative properties that may play a part in the breakdown of methamphetamine. There is also a possibility that volatilization could have occurred during the preparation for GC/MS using chloroform and sodium hydroxide. Based on these initial observations, it appears that additional assessment of the effectiveness of bleach as a methamphetamine cleaning agent is warranted.

Conclusion

Results of this preliminary study indicated that bleach may be an effective cleaning agent to chemically break-down residual methamphetamine. This conclusion is based on the observation that street-grade methamphetamine

analysis showed methamphetamine concentrations greater than DMSO2 concentrations prior to the addition of bleach. Analysis after the bleach was added to the street-grade methamphetamine indicated that methamphetamine was not detectable relative to DMSO2. This study also indicated that the other common commercial cleaning products evaluated did not degrade methamphetamine.

The mechanism for the methamphetamine degradation via bleach is not clear. Further evaluation of the oxidative and pH properties of bleach are needed to determine what role pH may play in methamphetamine degradation. At pH 10.5 methamphetamine converts to methamphetamine base, thus the decrease of methamphetamine concentration may have been due to volatilization. If it is determined that methamphetamine reduction is due to the oxidative properties of bleach, then further research is necessary to determine the optimal concentration of bleach needed to completely break-down methamphetamine. Furthermore, if the oxidative properties of bleach are the cause of methamphetamine degradation, then testing the effectiveness of other oxidizing cleaners to degrade methamphetamine would be warranted.

The GC/MS analysis in the methamphetamine\bleach study was not conducted on a quantitative basis. The results only indicated if there was significant change in the peaks in comparison to the controls. We compared the peak height of methamphetamine to that of DMSO2 which was a marker agent within the street grade meth. DMSO2 allowed us to qualitatively measure the breakdown of the methamphetamine by comparison of peaks to controls.

The use of bleach to chemically breakdown controlled substances is not unprecedented. Bleach has been used to destroy evidence by cocaine manufacturers in Canada¹. Laboratories have been sampling containers with liquid bleach found at labs that have traces of cocaine. Because some of the samples had traces of cocaine and others did not, GC/MS was used to detect compounds present. The GC/MS data revealed that the compounds present were degradation products related to cocaine. These significant quantities of degradation products in the bleach gives us reason to believe that bleach may also react with methamphetamine in the same manner.

While the laboratory results were encouraging, the effectiveness of bleach as a decontaminating agent would need to be laboratory quantified and then field tested before any final conclusions regarding bleach as a cleaning agent could be determined. Furthermore, this preliminary study only looked at methamphetamine and no other potential chemicals of concern.

¹ Alexis Carpenter & Richard R. Laing, "Cocaine in Bleach: Destroying the Evidence. Identification of Degradation Products," *Microgram* Vol 27, No 8, 249-252 (1994)