Designation: ~~E1969 – 11~~ E1969 – 19

Standard ~~Guide~~Practice for Microcrystal Testing in Forensic Analysis ~~of~~for Methamphetamine and Amphetamine[1]

This standard is issued under the fixed designation E1969; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

Microcrystal tests are primarily chemical-precipitation tests in which a light microscope is used to observe and distinguish the different types of crystals formed. These tests require skill and expertise on the part of the analyst that can be gained adequately only through appropriate training and experience in their use. These tests should not be attempted by those who are unfamiliar with them for use in the analysis of methamphetamine or amphetamine.

1. Scope

1.1 This ~~guide~~practice describes ~~some standard~~ procedures applicable to the analysis of methamphetamine and amphetamine using microcrystal tests **(1-6)**.[2]

1.2 These procedures are applicable to methamphetamine and amphetamine, which are present in solid dosage form or an injectable liquid form. These procedures are not typically applicable to the analysis of methamphetamine and amphetamine in biological samples.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *These procedures could generate observations indicating a positive test for methamphetamine or amphetamine which could be incorporated into the analytical scheme as defined by the laboratory.*

1.5 *This standard cannot replace knowledge, ~~skill,~~skills, or ~~ability~~abilities acquired through appropriate education, training, and experience (see Practice E2326) and ~~should~~ is to be used in conjunction with sound professional ~~judgment.~~judgment by individuals with such discipline-specific knowledge, skills, and abilities.*

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate ~~safety~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

E1459 Guide for Physical Evidence Labeling and Related Documentation
E1492 Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Science Laboratory
E1732 Terminology Relating to Forensic Science
E2326 Practice for Education and Training of Seized-Drug Analysts
E2329 Practice for Identification of Seized Drugs
E2548 Guide for Sampling Seized Drugs for Qualitative and Quantitative Analysis

[1] This ~~guide~~practice is under the jurisdiction of ASTM Committee E30 on Forensic Sciences and is the direct responsibility on Subcommittee E30.01 on Criminalistics.
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[2] The boldface numbers in parentheses refer to a list of references at the end of this standard.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the ~~standard's~~standard's Document Summary page on the ASTM website.

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3. Terminology

3.1 ~~For definitions of terms used in this standard, refer to Terminology E1732.~~*Definitions:*

3.1.1 For definitions of terms used in this standard, refer to Terminology E1732.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aggregation, n*—the collecting of units or parts into a mass or whole.

3.2.2 *birefringence, n*—property of some crystals, those having more than one refraction index; this property will result in interference colors, which are viewed through a polarized light microscope.

3.2.2.1 *birefringent, adj*—material exhibiting birefringence.

3.2.3 *blades, n*—broad, flat, elongated crystals.

3.2.4 *grains, n*—thick tablets having nearly equal width, breadth and thickness.

3.2.5 *habit, n*—the external morphology of the crystal.

3.2.6 *microdrop, n*—a small drop of liquid that would fit on the end of a standard size, flattened toothpick; the approximate volume of this drop would be 10 to 25 µL.

3.2.7 *needles (acicular), n*—long, thin crystals with pointed ends.

3.2.8 *plates, n*—blades with nearly equal length and breadth and of a thickness substantially less than the width.

3.2.9 *rods, n*—long, thin crystals with squared off ends.

3.2.10 *tablets, n*—plates with appreciable thickness but less than the length or breadth.

4. Summary of the Technique

4.1 A small ~~sample~~amount of ~~the~~test material containing the suspected methamphetamine or amphetamine is dissolved in an appropriate acid and the appropriate precipitating reagent is added. The crystals that are formed are observed and distinguished utilizing a light microscope.

4.2 If the proper formation of crystals is inhibited by the presence of diluents, a purification of the ~~sample~~ test material based on the volatility of methamphetamine and amphetamine ~~may~~could be performed.

5. Significance and Use

5.1 This technique ~~produces~~involves a chemical-precipitation reaction between methamphetamine or amphetamine and the precipitating reagent. The habit and the aggregation of the crystals formed ~~may~~could be used to distinguish methamphetamine and amphetamine from other ~~drugs.~~drugs, as well as from each other.

6. Interferences

6.1 *Diluents/Adulterants*—Diluents/adulterants present in combination with methamphetamine or amphetamine in the ~~sample~~ test material to be tested ~~may~~could inhibit crystal formation or ~~result in~~could generate crystals that are distorted or otherwise rendered unidentifiable. Diluting the test material could reduce the interference. The higher the concentration of the adulterant the more difficult it will be to observe characteristic crystals. There could be cases where diluting the test material would not work. In these instances, it will be necessary to separate the methamphetamine or amphetamine from the ~~diluents~~diluents/adulterants or to use other testing methods to analyze the methamphetamine or amphetamine.

7. Apparatus

7.1 A standard light microscope capable of varying magnifications including 100× is needed for viewing the crystals. This is the minimum equipment required. A polarized light attachment is not essential, but is desirable, because the heavy metal crystals of methamphetamine and amphetamine are birefringent.

7.1.1 *Polarized Light Microscope (PLM),* capable of varying magnifications from 40× to 400×. The following are typical accessories on a PLM and could be useful, but are not required, to conduct microcrystalline testing: specialized rotating stage (360°) and compensator (retardation plate). Cross-polarizers are verified by observing a black background when the polarizer and analyzer are in the optical path at 90 degrees to one another (for example, polarizer is in the east-west direction and the analyzer is in the north-south direction).

7.1.2 The best practice for documenting the crystal formation results is to take a digital photograph. It is advised that the minimum equipment required also has the capability of digital photography.

8. Reagents and Materials

8.1 *10 % Solution of Hydrochloric ~~Acid.~~Acid* (hereafter, dilute hydrochloric acid).

8.2 *Concentrated Phosphoric Acid.*

8.3 *1.0 N to 10.0 N Sodium Hydroxide.*

8.4 *Gold Chloride ~~(HAuCl~~(HAuCl$_4$) Solution,* approximately 5 %, in reagent grade water. Gold chloride in phosphoric acid also is ~~suitable.~~suitable; 1:2 5 % gold chloride/concentrated phosphoric acid.

8.5 *Platinum Chloride (H_2~~PtCl~~PtCl$_6$) Solution,* approximately 5 %, in reagent grade water. Platinum chloride in phosphoric acid also is ~~suitable.~~suitable; 1:2 5 % platinum chloride/concentrated phosphoric acid.

8.6 ~~*Amphetamine Standard.*~~*d-, l-, and dl- Amphetamine Standards.*

8.7 ~~*Methamphetamine Standard.*~~*d-, l-, and dl- Methamphetamine Standards.*

9. Sampling, Test Specimens, and ~~Test Units—~~Test Units

9.1 The general handling and tracking of samples should meet or exceed the requirements of Practice E1492 and Guides E1459 and E2548.

10. ~~Calibration and Standardization~~Performance Verification

10.1 ~~The reagents utilized~~Prior to use in casework, the reagents used for these microcrystal tests ~~are to~~ shall be tested for reliability using amphetamine and methamphetamine standards and negative controls following the prescribed procedure. Only when it is determined that the reagents are producing the expected response ~~may~~could the reagents be used in the testing procedure.

10.2 The microscope should be inspected, adjusted, and aligned to ensure it is in proper working order. This can be confirmed during the testing of the standard. Perform the analysis of unknown samples and standards under the same microscope operating procedures (for example, use of cross polarizers).