Designation: E2451 – 21

Standard Practice for Preserving Ignitable Liquids and Ignitable Liquid Residue Extracts from Fire Debris Samples[1]

This standard is issued under the fixed designation E2451; 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.

1. Scope

1.1 This standard covers procedures for the preservation of ignitable liquids and ignitable liquid residue extracts obtained from fire debris samples and questioned ignitable liquid samples. Extraction procedures are described in Section 2, Referenced Documents.

1.2 Specific evaluation of this practice is limited to the preservation of gasoline and diesel fuel (**1-4**),[2] the components of which together span the range of chemical classes and volatility of ignitable liquid residues commonly encountered in fire debris 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 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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]

E1386 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Solvent Extraction

E1388 Practice for Static Headspace Sampling of Vapors from Fire Debris Samples

E1412 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration with Activated Charcoal

E1413 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Dynamic Headspace Concentration onto an Adsorbent Tube

E1459 Guide for Physical Evidence Labeling and Related Documentation

E1492 Practice for Receiving, Documenting, Storing, and Retrieving Evidence in a Forensic Science Laboratory

E1618 Test Method for Ignitable Liquid Residues in Extracts from Fire Debris Samples by Gas Chromatography-Mass Spectrometry

E1732 Terminology Relating to Forensic Science

E2154 Practice for Separation and Concentration of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration with Solid Phase Microextraction (SPME)

E3189 Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Static Headspace Concentration onto an Adsorbent Tube

E3197 Terminology Relating to Examination of Fire Debris

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminologies E1732 and E3197.

4. Summary of Practice

4.1 Extracts obtained from fire debris samples and questioned liquid samples are preserved and stored as evidence, which also allows for potential reanalysis using Test Method E1618.

5. Significance and Use

5.1 The preservation and storage of extracts recovered from fire debris or liquids submitted in a fire investigation provides a mechanism for reanalysis in the event that the original evidence is altered due to factors such as the extraction process (Practices E1386 and E1413), sample degradation, or failure of the original evidence container during post-analysis storage.

5.2 Reanalysis of a stored sample extract could result in data that do not duplicate the data obtained during the initial

[1] This practice is under the jurisdiction of ASTM Committee E30 on Forensic Sciences and is the direct responsibility of 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 Document Summary page on the ASTM website.

analysis. Loss of the more volatile components of a stored sample can occur, and this possibility should be considered when interpreting data from a stored sample. Studies of gasoline and diesel show that results (that is, determination of presence and classification of an ignitable liquid, or determination of absence of an ignitable liquid) obtained from reanalysis data are in agreement with the initial analytical results. **(1-4)**

5.3 Preserved extracts are either returned to the submitter for storage or catalogued and stored by the laboratory or other designee.

6. Materials

6.1 *Preservation Container*—Preservation containers are tightly sealed, volatile-free, and chemically inert to the sample. An example of a suitable preservation container is a crimp-top glass vial with intact polytetrafluoroethylene (PTFE) lined seal.

6.2 *Adsorption Media*—Activated charcoal strips or loose activated carbon or equivalent.

7. Procedure

7.1 *Passive Headspace Concentration with Activated Charcoal* (Practice E1412):

7.1.1 *Adsorbent-Strip Adsorption:*

7.1.1.1 Activated charcoal strips are utilized either in their entirety, or they are divided before or after adsorption, but prior to elution.

7.1.1.2 If a single strip, or a single portion of a strip, is utilized, after analysis, preserve the extract by adsorbing it onto adsorption media (original or new) via solvent evaporation, and preserve the adsorption media in a preservation container. (**Warning—**Components of ignitable liquid residues that have similar volatility to the solvent can be lost during solvent evaporation.)

7.1.1.3 If two strips, or two portions of a strip, are utilized, use one strip, or one portion of a strip, for elution and analysis, and preserve the second strip, or second portion of a strip, in a preservation container.

NOTE 1—This procedure requires that both strips, or both portions of a strip, are adsorbed simultaneously.

7.1.2 *Adsorbent Package Adsorption:*

7.1.2.1 After elution and analysis, preserve the extract by adsorbing it onto adsorption media (original or new) via solvent evaporation, and preserve the adsorption media in a preservation container. (**Warning—**Components of ignitable liquid residues that have similar volatility to the solvent can be lost during solvent evaporation.)

7.2 *Dynamic Headspace Concentration and Static Headspace Concentration* (Practices E1413 and E3189):

7.2.1 *Activated Carbon or Equivalent with Solvent Desorption*—After analysis, preserve the extract by adsorbing it onto adsorption media (original or new) via solvent evaporation, and preserve the adsorption media in a preservation container. (**Warning—**Components of ignitable liquid residues that have similar volatility to the solvent can be lost during solvent evaporation.)

7.2.2 *Tenax*[4] *TA or Equivalent with Thermal Desorption*—Extracts obtained using this process are consumed during analysis and are not amenable to preservation. Consider an alternative process if the preservation of extracts is required.

7.3 *Solvent Extraction* (Practice E1386):

7.3.1 After analysis, preserve the extract, or a portion of the extract, by adsorbing it onto adsorption media, and preserve the adsorption media in a preservation container.

7.3.2 Preserve any remaining extract liquid phases in a preservation container.

7.4 *Liquid Samples:*

7.4.1 After analysis, preserve the liquid, or a portion of the liquid, in a preservation container.

7.4.2 Alternatively, preserve a portion of the liquid by adsorbing it onto adsorption media, and preserve the adsorption media in a preservation container.

7.5 *Static Headspace and SPME* (Practices E1388 and E2154):

7.5.1 While these sampling techniques are considered non-destructive to the original fire debris sample, the extracts obtained are consumed during analysis and are not amenable to preservation. Use an additional or alternative technique if the preservation of extracts is required.

8. Storage

8.1 Label all preservation containers as evidence and in accordance with Guide E1459.

8.2 Document preservation of extracts in accordance with Practice E1492.

8.3 Preserved extracts are either returned to the submitter for storage with the original evidence as an attachment or enclosure, or they are catalogued and stored by the laboratory or other designee.

8.3.1 Storage conditions outside the laboratory's control cannot be guaranteed by the laboratory.

8.3.2 Laboratories should provide the submitter or other designee with guidance regarding storage conditions.

8.4 Store preserved extracts at room temperature (approximately 22 °C) or lower. (**Warning—**Exposure to higher temperatures can result in the evaporative loss of lower boiling compounds from a stored extract **(1)**.)

8.5 When accepting a preserved extract for reanalysis, documentation relating to storage conditions and chain of custody records should be included. Such information can assist in the interpretation of the analyses of preserved extracts.

9. Keywords

9.1 analysis; extract preservation; fire debris; forensic science; ignitable liquid residue; preservation; sample extract; sample preservation; storage

[4] Tenax is a trademark of Buchem B.V. in Apeldoorn, Netherlands.

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