Designation: E1386 − 15

Standard Practice for
Separation of Ignitable Liquid Residues from Fire Debris Samples by Solvent Extraction[1]

This standard is issued under the fixed designation E1386; 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 practice covers the procedure for removing small quantities of ignitable liquid residue from samples of fire debris using solvent to extract the residue.

1.2 This practice is suitable for successfully extracting ignitable liquid residues over a wide range of concentrations.

1.3 Alternate separation and concentration procedures are listed in the referenced documents (Practices E1388, E1412, E1413, and E2154).

1.4 This practice offers a set of instructions for performing one or more specific operations. This standard cannot replace knowledge, skill, or ability acquired through appropriate education, training, and experience and should be used in conjunction with sound professional judgment.

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

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 and health practices and determine the applicability of regulatory limitations prior to use.* For a specific hazard statement, see 5.5.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E1388 Practice for Sampling of Headspace 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

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

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

E2451 Practice for Preserving Ignitable Liquids and Ignitable Liquid Residue Extracts from Fire Debris Samples

3. Summary of Practice

3.1 A sample of fire debris is extracted with an organic solvent. The extract is filtered and concentrated as necessary.

4. Significance and Use

4.1 This practice is useful for preparing extracts from fire debris for later analysis by gas chromatography-mass spectrometry (GC/MS).

4.2 This is a very sensitive separation procedure, capable of isolating quantities smaller than 1 µL of ignitable liquid residue from a sample.

4.3 This practice is particularly useful when the potential for fractionation during separation must be reduced, as when attempting to distinguish between various grades of fuel oil.

4.4 This practice is particularly useful for the extraction of nonporous surfaces such as glass, or the interior of burned containers. It is also particularly well suited to the extraction of ignitable liquid residues from very small samples, very large samples, or samples that are not suitable for heating.

4.5 This practice is not specific to ignitable liquids and can be hampered by coincident extraction of interfering compounds present in the fire debris samples.

4.6 This practice may not be useful for the extraction of some extremely volatile ignitable liquids, which may evaporate during the concentration step.

---

[1] This practice is under the jurisdiction of ASTM Committee E30 on Forensic Sciences and is the direct responsibility of E30.01 on Criminalistics

Current edition approved May 1, 2015. Published June 2015. Originally approved in 1990. Last previous edition approved in 2010 as E1386 – 10. DOI: 10.1520/E1386-15.

[2] 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.

4.7 This is a destructive technique. Whenever possible, this technique should only be used when a representative portion of the sample can be preserved for reanalysis. Those portions of the sample subjected to this procedure may not be suitable for resampling. If destruction of the sample is an issue, consider using passive headspace concentration as described in Practice E1412.

5. Reagents and Materials

5.1 *Purity of Reagents*—Reagent grade or better chemicals shall be used in all tests. It is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[3] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

5.2 *Solvent*—A suitable single component solvent (polar or non-polar), with high volatility to allow concentration by evaporation, such as carbon disulfide, pentane, methylene chloride, or diethyl ether.

NOTE 1—Polar oxygenated solvents (such as alcohols) may not be soluble in non-polar solvents (such as pentane). In order to examine for the presence of polar oxygenated solvents, it may be necessary to perform an additional extraction technique, such as analyzing a sample from the headspace (Practice E1388) prior to performing a solvent extraction.

5.2.1 Check solvent purity by evaporating to at least twice the extent used in the analysis and analyzing the evaporated solvent in accordance with Test Method E1618.

5.2.2 Read and follow the safety precautions described in the safety data sheet (SDS) of the extraction solvent that is used.

5.3 *Filter paper or filter apparatus,* free of extractable hydrocarbons.

5.4 *Beakers, vials, or other extraction containers,* free of extractable hydrocarbons.

5.5 *Compressed dry nitrogen, filtered air, or inert gas.* (**Warning—**These gases are stored under high pressure.)

6. Procedure

6.1 Observe the appropriate procedures for handling and documentation of all submitted samples as described in Practice E1492 and Guide E1459.

6.1.1 Open and examine the fire debris sample in order to determine that it is consistent with its description.

6.1.1.1 Resolve any discrepancies between the submitting agent's description of the evidence and the analyst's observation with the submitting agent prior to the completion of the report.

6.2 Select an appropriate size container to perform the extraction.

6.3 If possible, select a representative portion of the sample to extract.

6.3.1 Record in the case notes a description of the portion of the sample extracted.

6.4 Add sufficient solvent to thoroughly moisten the sample.

6.5 A record of the solvent manufacturer, grade and lot number used shall be maintained.

6.6 Mix the solvent and debris. An extraction time of less than one minute is usually sufficient.

6.6.1 Simple rinsing of nonporous surfaces may be sufficient for adequate extraction of residues.

6.6.2 Multiple small volume extractions may be used; this technique is more efficient than a single large volume extraction. The multiple small volumes may be combined and concentrated as necessary.

6.7 Decant the solvent and filter if necessary.

6.8 If needed, evaporate the solvent to an appropriate volume.

6.8.1 Sufficiently concentrated samples do not require evaporation.

6.8.2 Evaporation techniques may include dry nitrogen, filtered air, inert gas, vacuum techniques or simple evaporation.

6.9 Code or label an appropriately sized vial in accordance with Guide E1459.

6.10 Transfer the solvent into the prepared container and cap.

6.11 Prepare a system blank to approximate the most reduced sample. An equivalent amount of the extraction solvent shall be analyzed (reduced and filtered if necessary) in the same manner as sample(s) under analysis.

6.12 Follow the extract storage procedures described in Practice E2451.

7. Keywords

7.1 fire debris samples; solvent extraction

---

[3] *Reagent Chemicals, American Chemical Society Specifications,* American Chemical Society, Washington, DC, http://www.chemistry.org. For suggestions on the testing of reagents not listed by the American Chemical Society, see the *United States Pharmacopeia and National Formulary,* U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD, http://www.usp.org.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/