



Designation: **E1412 – 16** **E1412 – 19**

# Standard Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration Withwith Activated Charcoal<sup>1</sup>

This standard is issued under the fixed designation E1412; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice describes the procedure for separation of small quantities of ignitable liquid residues from samples of fire debris using an adsorbent material to extract the residue from the static headspace above the sample, then eluting the adsorbent with a solvent.

1.2 While this practice is suitable for successfully extracting ignitable liquid residues over the entire range of concentration, the headspace concentration methods are best used when a high level of sensitivity is required due to a very low concentration of ignitable liquid residues in the sample.

1.2.1 Unlike other methods of separation and concentration, this practice is essentially nondestructive.

1.3 Alternate separation and concentration procedures are listed in the referenced documents (see Practices [E1386](#), [E1388](#), [E1413](#), and [E2154](#)).

1.4 This practice does not replace knowledge, skill, ability, experience, education, or training and should be used in conjunction with 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, health, and 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:*<sup>2</sup>

[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

[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

[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

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee [E30](#) on Forensic Sciences and is the direct responsibility of Subcommittee [E30.01](#) on Criminalistics. Current edition approved ~~Jan. 15, 2016~~ Nov. 15, 2019. Published ~~February 2016~~ December 2019. Originally approved in 1991. Last previous edition approved in 2012 [E1412 – 12](#); [E1412 – 16](#). DOI: ~~10.1520/E1412-16~~ 10.1520/E1412-19.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the [standard's](#) Document Summary page on the ASTM website.

### 3. Summary of Practice

3.1 Charcoal in some form of an adsorption package is placed in the sample container to adsorb ignitable liquid residues. The container may be heated or left at ambient temperature. The charcoal is removed and eluted with a suitable elution solvent as listed in 6.3.

### 4. Significance and Use

4.1 This practice is useful for preparing extracts from fire debris for later analysis by gas chromatography mass spectrometry.

4.2 This is a very sensitive separation procedure, capable of isolating quantities smaller than  $\frac{1}{10}$   $\mu\text{L}$  of ignitable liquid residue from a sample.

### 5. Apparatus

5.1 *Heating System*—An oven, or a heating mantle to fit the evidence container (or a hot plate).

5.1.1 An oven is recommended to achieve a constant temperature throughout the system.

5.2 *Temperature Measuring Device*—A thermometer or thermocouple capable of measuring temperatures in the range of 40 to 100°C.

5.3 *Adsorption Package*.

5.3.1 Commercial charcoal adsorption packages are available from several companies. These packages, in the form of polymer strips or small charcoal canisters or “C-bags,” are used to adsorb organic vapors.

5.3.1.1 The minimum recommended polymer strip size is 10 mm by 10 mm, or 100 mm<sup>2</sup>.

5.3.2 *Non-Commercial Adsorption Packages*.

5.3.2.1 *C-Bags*—Prepare C-bags by encapsulating 0.2 g of activated charcoal within a folded sheet of high strength, light weight, high porosity tissue paper, such as that commonly used for making tea bags.<sup>3</sup>

5.3.3 *Storage of Adsorption Packages*—To prevent contamination, store all adsorption packages away from any sources of organic vapors prior to and after sampling.

### 6. Reagents and Materials

6.1 *Purity of Reagents*—Reagent grade or better chemicals shall be used in all tests. Unless otherwise indicated, 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.<sup>4</sup> 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.

6.2 *Adsorption Package*:

6.2.1 *C-Bags*:

6.2.1.1 4 by 5 in. (approximate) high strength, light weight, high porosity filter paper.

6.2.1.2 Activated charcoal.

6.2.2 Commercial charcoal adsorption package.

6.2.3 ~~Check charcoal media purity by, at a minimum, desorbing a representative unit using the same elution solvent as will be used for questioned samples and analyzing in accordance with Test Method E1618.~~ When necessary, charcoal can be activated and cleaned by heating in a 400°C oven for E1618.4 h, then cooled in a desiccator.

6.3 *Elution Solvent*—Suitable elution solvents are carbon disulfide, ~~*n*-pentane~~, ~~pentane~~, or diethyl ether. Use of a heavier solvent, such as toluene or tetrachloroethylene, is sometimes necessary when the compounds of interest have low molecular weights.

6.3.1 ~~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.~~

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

### 7. Sample Preparation/Adsorption Procedure

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

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

7.1.1.1 Resolve any discrepancies between the submitting agency’s description of the evidence and the analyst’s observation prior to the completion of the report.

<sup>3</sup> Dietz, W. R., “Improved Charcoal Packaging for Accelerant Recovery by Passive Diffusion,” *Journal of Forensic Sciences*, Vol 35, 1991, pp. 111–121 (Unk).

<sup>4</sup> *Reagent Chemicals, American Chemical Society Specifications, ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmaceutical Pharmacopeial Convention, Inc. (USPC), Rockville, MD.