5.1.2.3 Fire Debris Analysis – Static Headspace

Adsorption-Elution is a headspace sampling. It relies on volatility of the ignitable liquid or ignitable liquid residue. Volatilized sample products if present, are trapped on an activated charcoal strip, also called a c-strip.

Evidence Packaging - The submitted container (nylon bag or metal can) or the sample itself (ex: debris itself) will be placed inside a laboratory heatsealed clean/unused nylon bag for the extraction time frame (when practical). This will apply to both oven or room temperature extractions. This will ensure knowledge of the integrity of the outer packaging, providing an airtight seal and prevent cross contamination.

5.1.2.3.1 Static (Passive) Headspace Concentration (Adsorption-Elution) - Procedure for Analysis - Preparation of the activated charcoal strips

Charcoal Strips - The strips come packaged in an airtight package and are accompanied by paperwork showing Lot Number and quality control testing data by the manufacturer. This information should be kept at the laboratory where the strips are being used for extractions. See ARSON-PM 5.1.1 – 5.1.1.4 Minimum Standards and Controls for requirements.

- Cut the appropriate number and size strips (number of samples and blanks)
- The strips as received are approximately 8 x 20mm in size. At least ½ strip (approximately 8 x 10mm) shall be used for placement inside the evidence container for adsorption. The same size strip (same as the evidence strip) shall be used for control samples.
- The strip can be stapled into a small gauze pouch/packet (so the strip will not fall out) or suspended above the evidence in some manner (string or paperclip, etc.)
- Care should be taken to not leave the strips open to the atmosphere more than a few minutes. Sample strips can be prepared ahead of time and stored in an airtight package (sealed nylon bag), or can be prepared before each case

5.1.2.3.2 Static (Passive) Headspace Concentration (Adsorption-Elution) - Procedure for Analysis - Sampling Debris:

Charcoal Strip Blanks - At least two different charcoal strip blanks shall be made for each case:

1) Make a **system blank** (same as method of analysis) by placing a strip in an appropriate container (nylon bag or metal can) and running it alongside the evidence through the whole process. (Processed in the same manner as the evidence).

   If contamination is indicated in the system blank:

   - Check the batch list and sample position in the instrument. If incorrect, correct and re-acquire.

- If contamination is indicated in the system blank, isolate the source by testing each component individually.
- No casework is to be conducted until resolution.
- The concurrent data will be evaluated to assess any impact on it from the contamination. If it is determined that the contamination may have impacted the ability to properly assess the data for the presence of ILR, the data should be recollected. If it is determined that there would be no impact on the ability to assess the data, recollection is unnecessary, and the rationale shall be provided in the worksheet.

Note: for labs doing extraction only, and pertaining to unknown liquid sampling, if the unknown liquid is sampled by placing some on a charcoal strip, a blank with a clean charcoal strip placed into a vial will also be made.

2) Make an **atmosphere blank** by placing a strip open to the atmosphere in the area of the evidence while extracting. At a minimum, this strip will be hung inside the oven with the evidence, or placed near the evidence if extracted at room temperature. If desired, the atmosphere blank can be a combination of the bench atmosphere (where the sample is prepared) and the oven.

Further additional blanks can be utilized at the discretion of the analyst.

Evidence Samples:
Place a strip into the inner evidence container (for example, through a tape covered slit in the nylon bag), adjacent or over the debris, and reseal. Do not leave container open more than a minute. Repeat for each sample to be tested.

- Place the sample(s) and blanks in an oven.

Heating times and temperatures:
The suggested temperature setting is between approximately 60 and 80°C for a minimum of two hours. The temperature and time may be adjusted according to facts associated with each sample.
Note: Temperatures lower than 60°C may be insufficient to volatilize compounds heavier than C16. Temperatures in excess of 80°C may result in disproportionate recovery of higher molecular weight compounds with the displacement of lower molecular weight compounds.

Normal screening: Adsorption times for routine screening of samples are typically in the range of 8 to 24 hours. For normal evidence screening, if shorter time is utilized, higher oven temperature must be used. It is not recommended to heat samples above 80°C. If lower temperatures are used, a longer number of hours will be used (8 hrs to overnight)

Strong odor: If a strong odor of possible petroleum products is noticed during sample preparation, it may be appropriate to extract that sample at room temperature or for shorter times in the oven. The amount of time for this extraction is at the discretion of the analyst. The sample may be heated or heated longer and re-extracted later if it appears that full sampling was not achieved at room temperature or for short times.

Special circumstances: Room temperature extraction is appropriate for items such as those being forwarded for latent print analysis, some biological samples, strong smelling items, etc. If samples are extracted at room temperature, a minimum of 8 hrs is recommended depending on the circumstances.

Extract Handling:

- After the appropriate time in the oven, remove the evidence and blank samples and allow them to cool to room temperature.
- Remove the strip(s) and reseal the sample container.
- Remove the charcoal strip, cut in half (if not in half already). Place 1/2 into an appropriately labeled auto sampler vial for analysis ***(this is considered work product and can be discarded after the report is released***) and the remaining 1/2 into a duplicate appropriately labeled vial that is not analyzed (***this is considered derivative evidence and will become an evidence item or container, acquiring a chain of custody***) resulting in 1 set of 2 vials for each evidentiary sample.

Extraction Only Laboratories: FSD laboratories who perform extraction only will send one sample set to another FSD laboratory who will run GC/MS, interpret the results and issue a report of those results. The extraction only laboratory will package the other sample set for return to the agency with the evidence. The extraction only laboratory will issue a report listing the evidence and add a statement that extracts were sent to another laboratory for analysis.

Full Analysis Laboratories:

- Add solvent - Usually A.C.S. Reagent Grade Carbon Disulfide (CS_2) to cover the strip and seal the vial. (Atmosphere blank is placed in vial at this time also)
- **Internal Standard (optional):** 0.1 µL or 0.5 µL of an internal standard may be added to the sample in order to check on the efficiency of the procedure. Internal standards are typically prepared using a single compound that is easily identified (such as 3- or 4-phenyltoluene or diphenylmethane) dissolved in the eluting solvent. If an internal standard is used, the blanks for those samples must also include the internal standard.
- The capped glass vial(s) are loaded into the tray of the GC/MS auto-sampler. The recommended sample injection volume is 1.0 µl.

References:

See ARSON-PM 5.1.7 Fire Debris Analysis - References