OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need: Evaluation and Quantitative Comparison of Different Extraction Methodologies for Ignitable Liquids

Keyword(s): Ignitable Liquid, Extraction, Adsorbent, Desorption, Headspace Extraction, Thermal Desorption, Activated Carbon, Tenax, Solid Phase Microextraction

Submitting subcommittee(s): Ignitable Liquids, Explosives, & Gunshot Residue

Date Approved: 3/02/2021

(If SAC review identifies additional subcommittees, add them to the box above.)

Background Information:

1. Does this research need address a gap(s) in a current or planned standard? (ex.: Field identification system for on scene opioid detection and confirmation)

Yes - ASTM E1386, E1388, E1412, E1413, E2154, E3189.

The choice of the Extraction/Elution method for processing Fire Debris for Ignitable Liquid Residues (ILR) analysis can affect the detection of ILR. There are a variety of choices for the extraction and elution process that, depending on the nature of the fire debris sample, can result in excellent to poor detection results, including type of extraction, time of extraction, elution solvent, and others.

2. Are you aware of any ongoing research that may address this research need that has not yet been published (e.g., research presented in conference proceedings, studies that you or a colleague have participated in but have yet to be published)?

Dr. Michael Sigman at NCFS.

3. Key bibliographic references relating to this research need: (ex.: Toll, L., Standifer, K. M., Massotte, D., eds. (2019). Current Topics in Opioid Research. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88963-180-3)

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2. Phelps, J., Chasteen, C., Render, M. (1994). Extraction and analysis of low molecular weight alcohols and acetone from fire debris using passive headspace concentration, *Journal of Forensic Sciences*, 39(1), pp. 194-206.
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5. Mann, D., Putaansuu, N. (2006). Alternative Sampling Methods to Collect Ignitable Liquid Residues, *Fire and Arson Investigator*, 57(1), pp. 43-46.
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8. Hall, S., White, G., Gautam, L. (2016). The Development of a Novel Adsorbent for Collecting Ignitable Liquid Residues from a Fire Scene, *Journal of Analytical and Applied Pyrolysis*, 122, pp. 304-314.

9. Massey, D., Du Pasquier, D., Lennard, C. (2002). Solvent desorption of charcoal strips (DFLEX) in the analysis of fire debris samples: Replacement of carbon disulfide, *Canadian Society of Forensic Science Journal*, 35(4), pp. 195-207.
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11. Newman, R., Lothridge, K. (1996). The effects of time, temperature, and concentration in the use of activated charcoal strips in fire debris analysis, In *Current Topics in Forensic Science*, Tokyo, Japan: Shunderson Communications, pp. 218-224.
12. Fabritius, M.M., Broillet, A., Konig, S., Weinmann, W. (2018). Analysis of volatiles in fire debris by combination of activated charcoal strips and automated thermal desorption-gas chromatography-mass spectrometry, *Forensic Science International*, 289, pp. 232-237.
13. Baechler, S., Comment, S., Delemont, O. (2010). Extraction and concentration of vapors from fire debris for forensic purposes: Evaluation of the use of Radiello Passive Air Sampler, *Talanta*, 82(4), pp. 1247-1253.
14. Analytical tools for the analysis of fire debris. A review: 2008–2015: https://www.sciencedirect.com/science/article/pii/S0003267016305499;
15. Advances In Fire Debris Analysis – STARS: stars.library.ucf.edu/cgi/viewcontent.cgi?article=4412&.

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4. Review the annual operational/research needs published by the National Institute of Justice (NIJ) at https://nij.ojp.gov/topics/articles/forensic-science-research-and-development-technology-working-group-operational#latest? Is your research need identified by NIJ?

No.

5. In what ways would the research results improve current laboratory capabilities?

A comparative and quantitative evaluation of extraction techniques will enable laboratories to choose methods with higher extraction efficiencies while avoiding those with less than ideal extraction efficiencies for a given fire debris sample type.

6. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

While some qualitative research has been carried out relating to extraction methods, the extraction/desorption efficiencies have not been quantitatively assessed for many adsorbents and eluting solvents. Quantitative assessment of the ASTM methods for fire debris extraction would fill a fundamental knowledge gap in forensic ignitable liquids analysis by establishing a basis for justification of selecting one method over another.

7. In what ways would the research results improve services to the criminal justice system?

If certain methods are found to have superior extraction/desorption efficiencies compared to other methods, these optimal methods will more commonly be chosen by laboratories, thus increasing standardization nationally.

8. Status assessment (I, II, III, or IV): II

	Major gap in current knowledge	Minor gap in current knowledge
No or limited current research is being conducted	I	III
Existing current research is being conducted	II	IV

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.