## B82 Fire Debris Analysis: Where Did We Come From? Where Do We Stand Today? Where Should We Go Tomorrow?

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After attending this presentation, attendees will learn about the history of fire debris analysis, its present state-of-the-art and limitations of fire debris analysis, and on what the future research in this field should focus. They will be able to go back to their laboratory, motivated to design and carry out the needed research in fire debris analysis. They will also have a good understanding of why some techniques, wrongly advertised as good for fire debris analysis, should be avoided.

This presentation will impact the forensic community and/or humanity by providing a better understanding of the present problematic in fire debris analysis: the interpretation of the results. This will result in the proper orientation of the future research in fire debris analysis, conducted by both practitioners and researchers. This research should fill the gaps and lead to an amelioration of the analysis of fire debris sample: a seriously needed improvement in forensic sciences.

It is not clear when the very first time a liquid accelerant was detected at a fire scene, but it appears that it was in the 1930s. In his 1938 book on scientific police, Marc Bischoff provided clear details of the fundamental principles of why ignitable liquid residues (ILR) at fire scenes can be detected. At that time, not only did the science stop at merely detecting the presence of such liquid, but also such detection was done in a presumptive manner rather than in a confirmatory one. The story of detecting lamp oil by soaking breadcrumbs in the suspicious liquid in order to taste it is not a legend.

In about 80 years, fire debris analysis has come very far and has accomplished an enormous amount of progress in the detection of ignitable liquid residues. Today, gas chromatography-mass spectrometry (GC-MS) is the analytical gold standard in the analysis of extracts from fire debris samples. Many other techniques have been proposed in the last few years, but only few, if any, could surpass GC- MS as the technique of tomorrow. As an example, gas chromatography- mass spectrometry/mass spectrometry, believed by a few as the answer to a better analysis of ILR, does not constitute an appropriate technique in this particular application. Its very high sensitivity contributes to lesser specificity and, therefore, to a decrease in the significance of the results. Accordingly, it should be completely avoided in fire debris analysis. Conversely, two-dimensional comprehensive gas chromatography-mass spectrometry (GCxGC-MS) is another emerging technique that offers a tremendous improvement in the analysis of ILR. It may not only become the gold standard of tomorrow, but it may also bring new insight into the interpretation of the results obtained with today's technology.

Presently, the interpretation of results is the weak point in the analysis of fire debris samples. While the technology has advanced tremendously since the beginning, and is the state-of-the-art level in analytical chemistry today, the interpretation of results did not undergo the same advance. This is a serious concern that should be shared by all practitioners and, more importantly, by researchers. Future research in fire debris analysis should principally focus on the interpretation of results, on the criterion necessary to identify ignitable liquids, and on the presence and identification of interfering products.

Parallel research has also occurred on extraction techniques at the laboratory and on detection techniques at the fire scene. A little progress has been made in the last few years, but nothing that will revolutionize the way sample preparation is carried out. The use of different detection techniques at the fire scene (such as the Ignitable Liquid Absorbent) is also a concern that must be addressed with scientific rigor in crime laboratories. The emergence of alternate fuels is also a new challenge that fire debris analysts must contend with.

This presentation will first present a very brief retrospective of the evolution of fire debris analysis. The attendees will be able to understand where fire debris analysis comes from and on what bases modern practice was built. Then, the current status of fire debris analysis in terms of technological advances and, more importantly, knowledge will be introduced. At this point, a review of the gaps in the present techniques will be thoroughly discussed. The assessment of the needs in the field of fire debris analysis will be given. Finally, the attendees will learn in which direction fire debris analysis should head tomorrow. This presentation should stimulate practitioners and researchers in the field to carry out the future research that is highly needed to make fire debris analysis progress to the next logical step.

**Fire Investigation, Chromatography, Ignitable Liquid Residues**

 ** Presenting Author*