APPLICATION NOTE – Fire Investigation

THE ART OF GC-MS FOR FIRE INVESTIGATION

PORTABLE GC-MS UNITS LIKE THE G510 CAN CONFIRM SUSPECTED ACCELERANTS ON-SCENE

SUMMARY

Fire investigators rely on a variety of tools to assist them in their mission to determine the cause and origin of a fire. At times, interpreting the results produced by those tools can be as much art as it is science. Fire investigators are detective, scientist, engineer, and law enforcer all-in-one. So, when and where can a gas chromatograph mass spectrometer (GC-MS) aid them in their mission? A portable GC-MS can be used to confirm the presence of a suspected accelerant immediately on-scene to better inform action plans.

FIRE SCENE INVESTIGATION

After a fire scene is determined to be safe, fire investigators begin with a visual assessment of the area. They look for burn patterns or suspicious areas that may indicate the origin of the fire. But the next step is to determine - how did it start?

If the burn patterns or visual clues indicate an accelerant might have been used, the scene will likely be treated as suspicious and investigators will work to confirm the presence of an ignitable liquid. A portable GC-MS, like the FLIR Griffin™ G510 (Figure 1), can be used to confirm the presence of a suspected accelerant immediately on-scene.

GC-MS is a gold-standard technology used both inside and outside of labs to analyze complex samples, like fire debris. It is a selective and sensitive tool that offers the broadest chemical detection capability. It is the ultimate confirmatory tool. Results can be produced in just a few minutes, expediting decision-making at the point of sample collection.

On the fire scene, the investigator can collect a sample from the fire debris and perform either a liquid extraction or solid-phase microextraction (SPME), before introducing it to the injector on the GC-MS. In addition to a standard injector, the FLIR Griffin G510 is equipped with an air sampling probe for extra utility at the fire scene.

The GC-MS identifies any constituents found present in the sample mixture. An expert in the field uses this chemical signature to determine the identity of an accelerant. Once an accelerant is confirmed, the investigator has the information needed to collect evidence for further investigation.

This application note demonstrates semi-volatile hydrocarbon analysis using the FLIR Griffin G510 portable GC-MS.

Figure 1: FLIR Griffin G510 Portable GC-MS

Syringe injection performed on Griffin G510

FLIR

DETECTION METHODS AND RESULTS

Figure 2 and Table 1 contain results from a single syringe injection, which identifies C9 through C28 hydrocarbons. For additional fidelity, customers can use Griffin Match Factor (GMF) technology, which combines NIST mass spectrum library matches with retention indexing to provide additional confidence. This is particularly helpful when analyzing similar chemicals. Figure 4 shows the different chromatographic signatures of Kerosene (a common accelerant) as it breaks down (or weathers) over time. Accelerants can often be matched to sources based on these weathering patterns.

#	Target	CAS #	Ret. Time (min)
C9	Nonane	111-84-2	3.33
C10	Decane	124-18-5	3.98
C11	Undecane	1120-41-4	4.58
C12	Dodecane	112-40-3	5.13
C13	Tridecane	629-50-5	5.65
C14	Tetradecane	629-59-4	6.11
C15	Pentadecane	629-62-9	6.58
C16	Hexadecane	544-76-3	7.01
C17	Heptadecane	629-78-7	7.42
C18	Octadecane	593-45-3	7.8
C19	Nonadecane	629-92-5	8.17
C20	Eicosane	112-95-8	8.52
C21	Heneicosane	629-94-7	8.87
C22	Docosane	629-97-0	9.19
C23	Tricosane	638-67-5	9.51
C24	Tetracosane	646-31-1	9.84
C25	Pentacosane	629-99-2	10.22
C26	Hexacosane	630-01-3	10.63
C27	Heptacosane	593-49-7	11.14
C28	Octacosane	630-02-4	11.78

Table 1. Retention times for the hydrocarbons identified

SUMMARY

The results from this study indicate the FLIR Griffin G510 is capable of field analysis of ignitable liquid residues at a fire scene. In suspected arson cases, crime laboratories can take six months or longer (depending on caseload) to provide a confirmatory indication that accelerants were used, highlighting the need for rapid on-site analysis tools like the FLIR Griffin G510. The ability to confirm the presence of suspected accelerants at the point of sample collection enable fire investigators to streamline decision making regarding evidence collection and processing.

For more information, please visit: www.flir.com/g510

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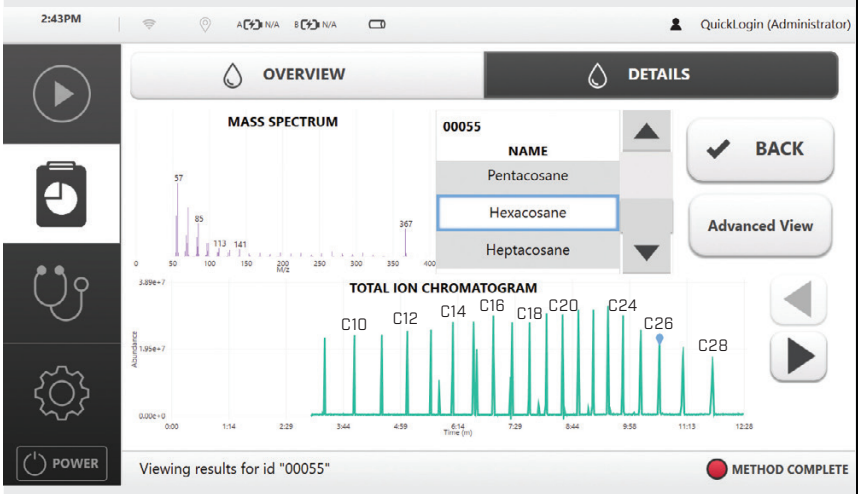

Figure 2: GSS Touch results for C9-C28 n-alkane mixture

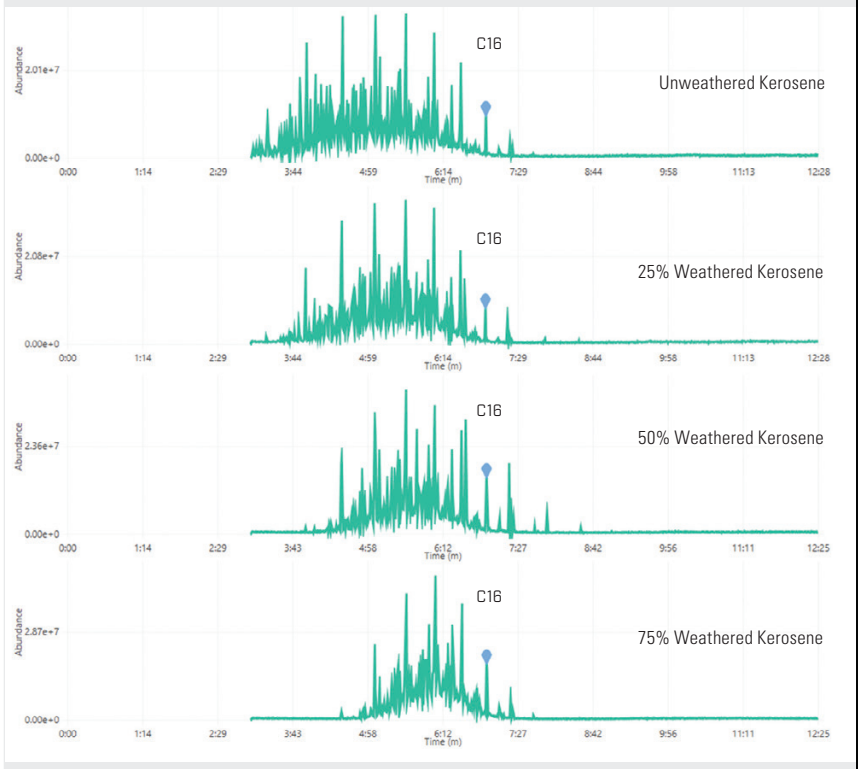

Figure 4: GSS Touch results for weathering across a series of Kerosene samples