TECHNICAL NOTE

Using a Portable GC/MS to Investigate Microbial Volatile Organic Compounds (MVOCs)

EVALUATING INDOOR AIR QUALITY

The home or business indoor air environment typically contains a variety of volatile organic compounds (Figure 1). Sources of VOCs may include building materials, consumer products, and fungi. High VOC concentrations from any source are mucous membrane irritants that affect the central nervous system, producing symptoms such as headache, attention deficit, inability to concentrate or dizziness [1].

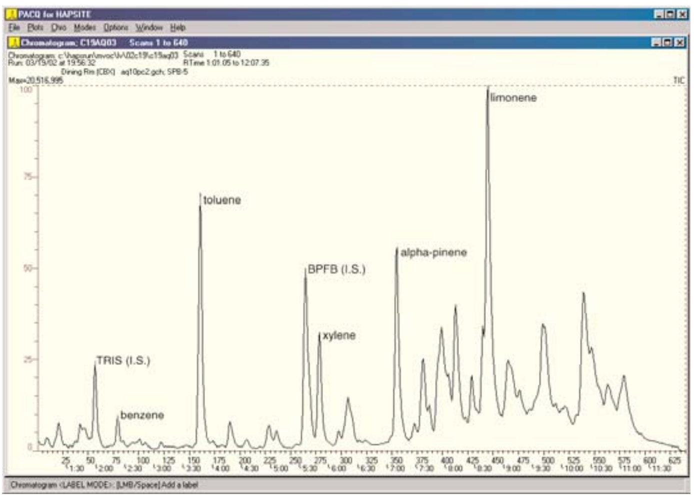

Figure 1 - Typical indoor air VOCs in a residential home.

Previous studies have focused on correlating health complaints to the detection and identification of molds. An alternative to directly measuring for mold spores is to measure the microbial VOCs (MVOCs) as markers for actively growing mold. In this scenario, the presence of measurable quantities of specific MVOCs indicates the growth of unseen molds behind walls, underneath carpets, above ceilings, and in other parts of the building structure. Health issues may originate from chronic exposure to MVOCs. Therefore, direct measurement of MVOCs could be the best means of evaluating indoor air quality and mold related health issues.

Gao et al [2] utilized earlier studies of MVOCs to develop a list of unique MVOCs (UMVOCs) as markers of mold growth. The reliability of this model was tested in the study by cultivating selected molds and evaluating the UMVOCs produced.

ANALYSIS USING A PORTABLE GC/MS

Indoor air sampling generates complex chromatograms requiring the separation and identification powers of GC/MS instrumentation. Completely field portable, HAPSITE GC/MS can be taken on-site to collect, concentrate, and thermally desorb the indoor air sample for GC/MS analysis. With detection limits in the low ppb/ppt concentration range, HAPSITE GC/MS is capable of detecting UMVOCs at the expected concentrations. To test this capability, an MVOC mixture was purchased from Protocol Analytical Supplies, Inc. for analysis using the HAPSITE Portable GC/MS, based on the Gao et al study[2].

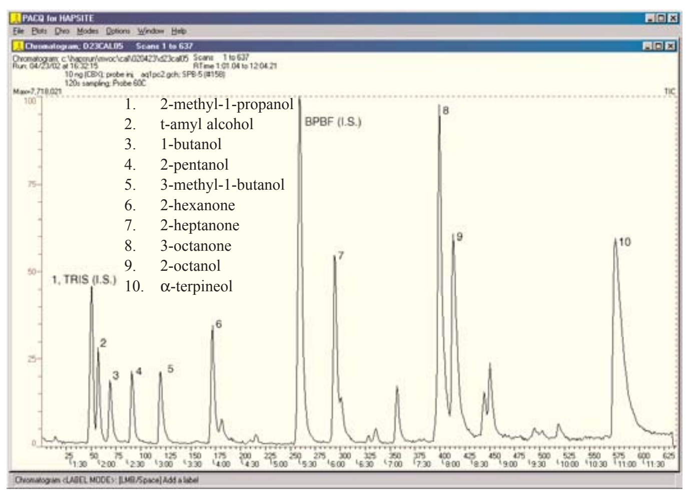

Figure 2 - MVOC standard mixture

Instrument Parameters:

Concentrator:	Carbopack X
Column:	SPB-5, 30m, 0.32 mm ID, 1.0 um d_f
Valve Oven:	60ºC
Temp. Profile:	50ºC for 0.5 min., to 80ºC at 7ºC/min, to 180ºC at 12ºC/min and hold 1.0 min.
Carrier:	N_2 at 3 ml/min at 60ºC
Mass Range:	41-300 amu

The MVOC standard chromatogram (Figure 2) is the result of loading 10 ng of each compound onto the microtrap concentrator. A 1 ng mass of each compound is readily detectable and corresponds to a concentration of approximately 1 ug/m^3 for a 10 minute sample collection time.

ON-SITE SAMPLING AND ANALYSIS

In a recent case study, sampling was performed by HAPSITE GC/MS in a single family home with confirmed mold growth at two of the interior walls. The house was built over a dirt floor crawl space. The house had been vacant for several months and had a musty smell when the new residents had moved in approximately two years earlier. The occupants began experiencing health problems when outside temperatures required heat from the furnace. It was discovered that the return air for the furnace was drawn from the crawl space.

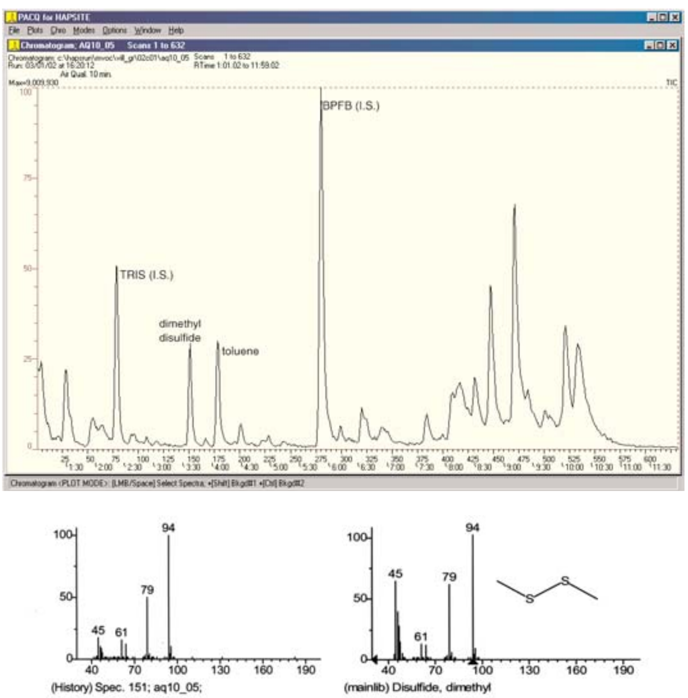

Figure 3 - On-site indoor air chromatogram and NIST library match for dimethyl disulfide.

Prior to sampling, the furnace was replaced, return air was ducted from the living area, and the dirt floor was covered with plastic.

Samples were taken in the living space and at ground level in the crawl space beneath the first floor living area. Figure 3 is the chromatogram from the crawl space sample. The mass spectrum at scan 151 and the NIST library search result identified the analyte as dimethyl disulfide (UMVOC list [2]). A HAPSITE calibration library was created and the concentration for the 10 minute sampling was determined to be 0.61 ug/m^3 or 0.16 ppbv. Dimethyl disulfide is commonly found at composting sites as an odorous emission product of bacterial decomposition. This compound may indicate the presence of organic material in the soil under the house.

CONCLUSION

HAPSITE Portable GC/MS is capable of detecting MVOCs at concentrations expected from actively growing mold.

Using HAPSITE GC/MS, the complex mixture of indoor VOCs from all sources can be evaluated in a single chromatogram within minutes of taking the sample.

The portability of HAPSITE GC/MS provides the advantages of directing additional sampling based on immediate data feedback, avoiding analyte losses due to sample collection vessels or devices, and the ability to sample behind walls or within the building structure as needed.

As demonstrated in this case study, HAPSITE Portable GC/MS provides laboratory quality GC/MS results on-site making it well-suited for MVOC analysis.

References:

1. Ammann, Harriet M.: Is Indoor Mold Contamination a Threat to Health?, Senior Toxicologist, Washington State Department of Health, Olympia, WA.

2. Gao, Pengfei; Korley, Frederick; Martin, Jennifer; Chen, Bean T.: Determination of Unique Microbial Volatile Organic Compounds Produced by Five Aspergillus Species Commonly Found in Problem Buildings, AIHA Journal 63:135-140 (2002).

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Two Technology Place, East Syracuse, NY 13057 USA
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