

Mobile GC/MS and Sampling Tools for Continuous Air Monitoring

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ICx Technologies develops and manufactures fieldable analytical instrumentation based on mass spectrometry (MS) technology. The small cylindrical ion trap (CIT) mass analyzer is housed in a smaller vacuum manifold and can be used at higher pressure, requiring less stringent vacuum pumping than traditional laboratory mass spectrometers. This small MS is interfaced with a low-thermal-mass (LTM) GC having a wide variety of sample inlets that can accept samples from vapor, liquid, and solid phases. This very versatile GC-MS system provides onboard air sampling, as well as a handheld vapor sampler that can be operated in harsh environments while in protective posture (e.g. MOP gear), and then directly interfaced with the GC-MS for analysis. This talk will present our most recent results on using the GC-MS onboard air sampler and the handheld air sampler for monitoring low concentration VOCs in ambient air in a variety of environments.

Internal lab and office air from multiple locations were monitored and characteristic signatures for isolated chemicals were obtained. The internal air analysis showed a wide variety of chemicals, such as hexane, cyclohexane, D5 (decamethylcyclopentasiloxane), and limonene. Over the course of 24 hours, these chemicals provided a chemical map of the staff's activity. The relative concentration of D5, a common ingredient in personal care products, began to rise at approximately 6:00 am and ebbed at around 6:30 pm. Additionally, limonene and hexane/cyclohexane signatures were present due to a staff member eating an orange prior to entering the lab and another staff member sonicating instrument parts in hexane, respectively. External air analysis was accomplished by plumbing a line from the instrument to a window and showed a completely different chemical signature demonstrating the presence of naphthalene, methyl naphthalene, and acenaphthalene. One week prior to this analysis, the parking lot was resurfaced and this activity is likely responsible for the chemicals detected by the GC-MS. Naphthalene provided the strongest signature however, the relative concentration fluctuated based on temperature and cloud cover. High exposure to sunlight proved to be the most important condition to releasing the chemicals from the parking lot surface.

The handheld air sampler was used for longer-term monitoring of air to detect trace levels of VOCs such as toluene. A calibration curve for toluene showed a detection limit of ~10 parts-per-trillion (ppt) with a linear dynamic range of at least three orders of magnitude for 40 minutes sampling time (20 L of air sampled). Air sampling in various locations inside and outside office buildings in a local business park, including in a brand new laboratory; interestingly, this new lab showed a toluene background concentration of over 100 times any of the other locations, presumably due to the offgassing of the new building materials.