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MEMORANDUM

To: AIR QUALITY CONSULTANTS

From: John Sliwinski
OSB Lab

Re: Managing Moisture Problems in Ambient Air Sampling and Analysis using Multisorbent Tubes

Date: 04.12.17

The problems associated with water include a large vapour expansion volume, poor wetability/solubility in many stationary phases, ion source instability, transient MSD decalibration and memory effects, loss of chromatography, artifact formation, and severe unreliable blank and background correction. Water must be eliminated prior to GC-MSD analysis.

Absorbed and condensed moisture on multisorbent tubes is controlled or removed in the laboratory during Helium gas thermal extraction transfer and splitting of field tubes onto laboratory analytical tubes via special gas expansion glass bulb water vapour traps. The amount of moisture collected during sampling is estimated from vapour condensation (fogging) and droplet formation at the 90º bent tube inlet protruding inside the bulb. If present, the majority of condensed water is deposited at the inlet or drips to the base of the trap. Some vapour is still entrained in the Helium gas and absorbs onto media in the analytical tube.

Depending on the amount of water vapour observed, the analytical tube is further dried, usually in reverse direction, at room temperature using dry Helium purge for at least 10 minutes. Drying time is then adjusted for the duplicate split sample depending on the previous GC-MSD run performance. This treatment is carried out exterior to the Envirochem 810A Inletting System.

Collection efficiency, washout, transfer loss, and recovery can be monitored at each stage using known addition target chemicals, their deuterated equivalents and selected environmentally absent or obscure laboratory compounds. Internal standards or surrogates cannot be reliably recovered when spiked directly onto wet multisorbent tubes which has been demonstrated by pre and post transfer spiking with surrogates. This is not evidence of sample loss rather it indicates that interference by moisture prevents reliable and reproducible calibration of GC-MSD runs.

If moisture is eliminated before instrumental analysis, tubes spiked for field quality control in the laboratory or in the field, prior to sampling ambient humid air, demonstrate good recovery for Vinyl Chloride, 1,1-Difluoroethane, Fluorobenzene and D10-p-Xylene. If interfering moisture remains during transfer, such field prespikes show more consistent recoveries than wet application internal surrogates added during the laboratory analysis procedure on the same sample.

Carbon molecular sieves have enormous capacity to absorb volatile organic compounds which has been observed during extreme overload events. Overloaded tubes are difficult to restore because they become deeply embedded with VOCs, extraction of which is not improved using high desorption temperatures and elevated purge flow rates.

Including water in the tube cleaning process (steam cleaning) does not decrease the time for the extraction period which appears to be diffusion controlled from within the carbon molecular sieve structure. Breakthrough losses for low VOC concentration ambient humid air are not likely an issue as much as calibration problems with wet tubes. Commercially available D3-Vinyl Chloride is available as a deuterated equivalent.