The Waterloo Membrane Sampler™ for Monitoring VOC Vapor Concentrations

Cost-effective indoor and outdoor air evaluation for human health risk assessment

SiREM is pleased to announce the availability of a new passive sampler, the Waterloo Membrane Sampler™ (WMS™) for monitoring VOC vapor concentrations. Originally developed at the University of Waterloo, this sampler has undergone three years of applied research and is now available for commercial use.

The design incorporates a polydimethylsiloxane (PDMS) membrane across the face of a vial filled with a sorbent medium. VOC vapors partition into and permeate through the membrane. The sorbent then traps the vapors, and the mass of each compound is determined by GC/MS. The uptake rate has been experimentally measured for many common VOCs and can easily be calculated for other compounds because it is directly proportional to the retention index, a property that is readily available in the scientific literature. Thus, you can use the WMS™ sampler to measure time-weighted average concentrations for virtually any VOC.

The WMS™ sampler offers several advantages compared to conventional air sampling methods:

- Lower cost
- Simpler sampling protocols
- Lower reporting limits without a premium price
- Longer time-integrated samples
- Very small size (discrete to deploy, and easy to ship)

Furthermore, the WMS™ sampler provides significant benefits compared to other quantitative passive air samplers:

- Predictable uptake rates for less common compounds
- Ability to measure Total Petroleum Hydrocarbons/Gasoline Range Organics
- Minimal effect of moisture (good for subsurface monitoring)
- Insensitive to wind velocity (good for outdoor and vent-pipe monitoring)
- Ability to modify uptake rate to avoid starvation effect
- Small diameter (easy to put in vent-pipes or sub-slab probes)
- Competitive pricing

The WMS™ sampler is available through SiREM and analytical services are provided by Air Toxics Ltd. (Folsom, CA), a specialty air laboratory.

Sampler in a glass overpack for shipping

Sampler being deployed for sub-slab gas sampling

Sampler deployed in a vapor off-gassing pipe

WATERLOO MEMBRANE SAMPLER™

For more information, contact:
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Equation 1

$$C = \frac{M}{t \times k^{-1}}$$

Equation 2

$$t = \frac{M_{LOQ}}{C_{RL} \times k^{-1}}$$

Close-up of membrane

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Determination of Concentration

Concentrations in the sampled air are calculated according to Equation 1, where:

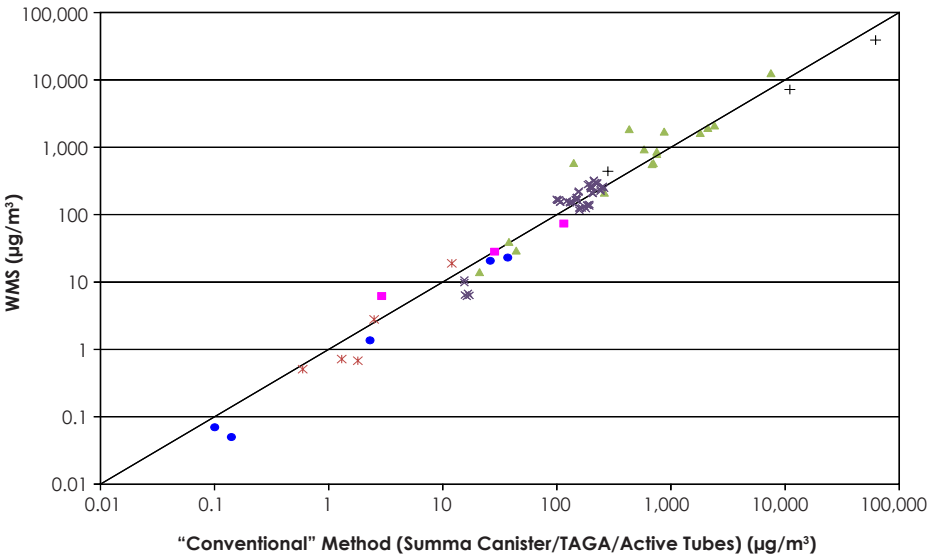
C = concentration in sampled air (µg/m³)
M = mass on sampler (picograms)
t = sampling time (min)
k^{-1} = known analyte-specific uptake rate (mL/min)

Reporting Limits and Sampling Time

The sampling time required to meet a desired reporting limit can be calculated using Equation 2, where:

t = sampling time required to achieve the reporting limit (min)
M_{LOQ} = minimum mass on sampler that analytical method can measure (picograms)
C_{RL} = reporting limit required (µg/m³)
k^{-1} = known analyte-specific uptake rate (mL/min)

Comparison of WMS™ VOC Results to Conventional Methods



Note: analytes are a variety of chlorinated volatile organic compounds

The WMS™ sampler results compare very well to "conventional" sampling results (Summa canisters, US EPA's Trace Atmospheric Gas Analysis (TAGA) unit, or active sorbent tubes) over at least six orders of magnitude.

References

Seethapathy, S., T. Górecki and X. Li, 2008. "Passive sampling in Environmental Analysis", *Journal of Chromatography A*, 1184, pp. 234–253.
Górecki, T. and J. Namiesnik, 2002. "Passive Sampling", *Trends in Analytical Chemistry*, 21(4), pp. 276-291.

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