Monitoring Indoor Air and Workplace VOCs with Diffusive Samplers

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Abstract

Air sampling involves collecting compounds under a variety of environmental conditions. While sorbent tubes with battery-operated pumps have been used for many years, diffusive samplers (badges) are becoming increasingly popular. Studies show that badges perform satisfactorily in the workplace with the added benefits of light weight, cost-effectiveness, and simplicity of use. Diffusive samplers are also quiet and have no intrinsic safety issues. SKC ULTRA® I and ULTRA II are diffusive samplers for VOCs that are available with different sorbents. These badges can be solvent or thermally desorbed and offer a variety of sampling rates. This paper will describe laboratory results for nitrous oxide in an occupational setting and for benzene and perchloroethylene during a 24-hour indoor air study in New York homes. The data show that the ULTRA I badge containing Molecular Sieve 5A samples accurately for nitrous oxide over a dose range of 12.75 to 890 ppm-hours. The indoor air study with the ULTRA II badge filled with Anasorb® GCB1 shows correlation coefficients between the badge and reference Summa® canister of 0.9533 and 0.9831 for low ppb-level benzene and perchloroethylene, respectively. Diffusive samplers continue to demonstrate the ability to sample complex environments given the proper selection of sorbents, extraction techniques, and sampling rates.

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Purpose

- **Badges can be used in a variety of settings including occupational, 24-hour vapor intrusion studies, and long-term (7-day) indoor air or ambient air studies.**
- **Badges can easily detect ppt levels if proper sorbents and extraction techniques are utilized.**

Nitrous Oxide Badge – 590 Series

- **590-300 is an ULTRA I-style badge pre-filled with 60/80 mesh Molecular Sieve 5A**
- **Analysis: Thermal desorption with electron capture GC**
- **Validation range: 12.75 to 890 ppm-hrs, 20 to 80% RH, 25 C**
- **Mean sampling rate: 0.81 ml/min (RSD 12%)**
- **Desorption Efficiency: 100%**
- **Storage: 3 weeks in freezer**
- **Uses: Surgical facilities**

Vapor Intrusion Evaluation

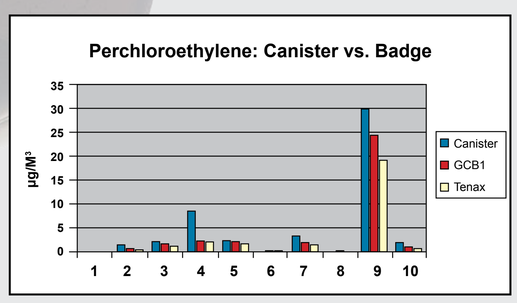
Canister vs. SKC ULTRA II Study

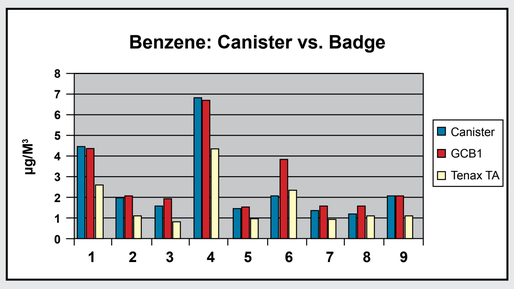
- **Side-by-side field study in 10 homes in New York state**
- **Main contaminants were from gasoline and dry-cleaning establishments**
- **Stainless-steel canister (1 liter) with TO-15 Full Scan**
- **ULTRA II badges containing Tenax® TA with TO-17 analysis**
- **ULTRA II badges containing Anasorb GCB1 with TO-17 analysis**
- **Samples were collected for 24 hours**

ULTRA II Badge – 590 Series

- **User-filled with separate vial of sorbent**
- **Any sorbent can be used**
- **Control the background by adding sorbent to badge when ready to sample**

New York Study Summary





ULTRA I Badge – 590 Series

- **Pre-filled with cleaned sorbent; any sorbent can be used**
- **Ready for use up to 30 days**
- **ULTRA I and II badges can be used with snap-on caps to reduce sampling rates and prevent sample loss**

575 Series Badge

- **Badges have large surface areas and are solvent extracted**
- **Proven performance in the laboratory and in the field**
- **Validated for short-term and 8-hour sampling**
- **Studies show suitability for 24-hour to 7-day sampling**

Monitoring VOCs for 7 days

Solvent Desorbed Badges

Compound	ppb	Expected Rate (ml/min)	Lab Rate (ml/min)	Badge Type
1,2-Dichloroethane	77	14.2	14.83	575 Series
Chloroform	75	13.0	14.06	575 Series
Ethyl benzene	103	12.9	11.66	575 Series
Methylene chloride	94	14.7	9.52	575 Series

Thermally Desorbed Badges

Compound	ppb	Expected Rate (ml/min)	Lab Rate (ml/min)	Badge Type
Benzene	84	0.56	0.646	590 Series*
Trichloroethylene	82	0.54	0.50	590 Series
o-Xylene	61	0.50	0.613	590 Series
Perchloroethylene	73	0.46	0.54	590 Series

* *These ULTRA I badges were used with a 12-hole secondary diffuser plate.*

Summary

- **Badges are a versatile tool for sampling compounds in many types of environments.**
- **Most compounds correlate well with established reference methods for 15 minutes up to 7 days.**
- **Badges can detect very low levels if thermal desorption is utilized; high sampling rates are not needed.**
- **Accurate and precise data can be generated if proper sorbents, extraction techniques, and sampling rates are selected.**