Science. Applied to Life.™

Technical Bulletin

April 5, 2022

ANALYSIS OF 3M™ ORGANIC VAPOR MONITOR 3501+/3511+ by GC/FID

STANDARD PREPARATION

Accurately weigh a Reference Standard for each analyte into a measured volume of chromatography-grade desorption solvent (typically benzene-free carbon disulfide which may have up to 3% benzyl alcohol or butyl alcohol) to make a Stock Standard Solution equivalent to of 1.0 mg of analyte per ml of desorption solvent. A Stock Standard may contain multiple Standard Analytes provided they do not co-elute in the chromatography system used. Date Stock Standards, store under refrigeration, and make fresh semi-annually. Dilute the Stock Standard Solution at least monthly using Internal Standard Solution to make 3-5 Working Standards in the range 0.5-500 µg per ml of Desorption Solvent. Date Working Standards, store under refrigeration, and make fresh weekly.

INTERNAL STANDARD SOLUTION

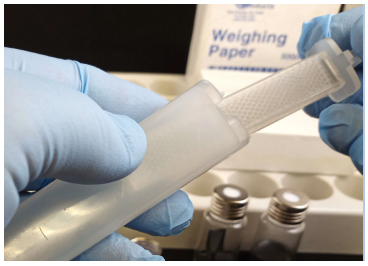
Accurately weigh pure (99+%) cyclohexane and n-decane to make a solution of 1-10 µg of each internal standard substance (accurately measured) per ml of Desorption Solvent.

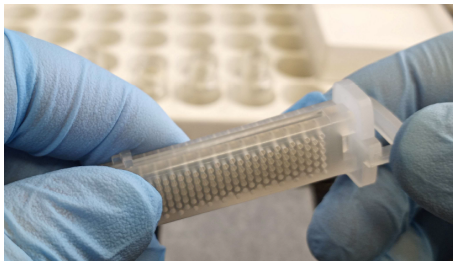
DESORPTION SOLVENTS AND DESORPTION EFFICIENCY

The IH Sampling Guide includes a list of monitors, analytes, suggested desorption solvent and reported desorption efficiency (DE). A mixture of 97% carbon disulfide with 3% (v/v) benzyl alcohol is often the suggested desorption solvent as it facilitates co-extraction of many polar and non-polar analytes from a single monitor. Other extraction solvents can be found in the NIOSH Manual of Analytical Methods or at the OSHA website. Labs who desire to use a different extraction solvent would need to determine their own DE values for each analyte on the appropriate monitor. A method for determining the DE is available (R.A. Dommer & R.G Melcher, (1978) AIHA Journal, 39:3, 240-246). To obtain an accurate value, it is good practice for individual labs to determine the DE at several (3-5) concentrations (µg of analyte per gram of media) that bracket the range of interest, and to determine the value at each concentration in triplicate. Some laboratories choose to re-determine DE values received from a 3rd party or to re-determine their own values from time-to-time. It has been shown that DE determinations may be made using multiple (at least 5) analytes in a single solution provided the analysis method used is capable of analyzing each analyte separately.

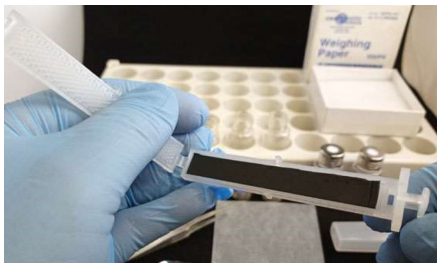
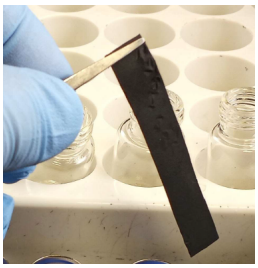
SAMPLE PREPARATION

Remove each Monitor to be tested from the Return Container. Grasp two sides of the Sampler Body near the top end (where the clip attaches) and pull the sides of the Sampler Body apart. Bend the sampler to pop open the latch, exposing a rectangular carbon strip. (The bottom end is hinged, and will not separate).






The one piece 3501+ swings open, making it very easy to grab the carbon strip with a forceps and roll into a cylinder. Using clean forceps, transfer the carbon strip into a 7 ml glass vial. (or similar) with inert closure cap system.


Immediately pipet 2.0 ml of Internal Standard Solution and cap the vial with inert, gas-tight closure. Agitate the vial continuously for one hour using an orbital shaker or equivalent. Reserve for gas chromatographic analysis.

BLANKS

Most laboratory tests involve the analysis of an associated background blank, consisting of reagents or media that have not been exposed to the analyte tested. When typical blank values are detectable (attributed to analyzable substances acquired extrinsically), a blank test result is subtracted from the value obtained from each test to obtain a “blank corrected value”. It is good practice to initially analyze several monitors to determine whether blank values are detectable or significant relative to the laboratory’s reporting limit. If blank values are detectable and significant, it is good practice to measure and retain an average blank value for each manufactured lot of monitors analyzed and subtract that blank value from each measured sample. In some cases, an average blank value may be obtained from the media manufacturer.

At least once per analytical batch, remove a similar Monitor which has not been exposed. Process the unexposed "BLANK" Monitor exactly as the Sample Preparations (above) and subtract any Peak Area response at the retention time of interest from the value obtained from the Sample Preparation. Report any significant BLANK values to Quality Assurance group along with the Lot number of the Monitor analyzed.

QUALITY CONTROL SAMPLES

During each run, analyze check standards and determine whether Analyte Standard responses fall within the Calibration Parameters specified for that Analyte and stored in the Computer. Investigate and resolve any deviation or discrepancy of Standards from the known Calibration Parameters before reporting results.

CAPILLARY GAS CHROMATOGRAPHY(GC) ANALYSIS

Inject an aliquot of the Sample Preparation from each Monitor to be analyzed into a Gas Chromatography System using the following conditions.

GC Columns (dual)	RT-1 (Column A); RTX-Volatiles (Column B)
Column Size	0.32 mm capillary x 60 m, 1.5 µm film thickness
Injection Mode	Split (typical 10:1)
Injector/Detector Temp	250°C / 280°C
Detector	Flame Ionization Detector (FID)
Column Temp	Hold 3 min 40°C; 15-25°C per min to 250°C; Hold 5 min
Injection Volume	1.0 microliter (nominal)

(*) Restek Corp, Bellefonte, Pennsylvania

Concomitantly, inject measured aliquots of a BLANK Preparation and 3-5 Standard Preparations in the range of interest (i.e. which bracket the concentrations of the Sample Preparations).

CALCULATION

Acquire the analytical data into a computer system in which chromatography data handling software has been installed. Using the software, compare the peak area ratio for analyte *vs* internal standard normalized for concentration from each Sample Preparation to the best-fit Calibration Curve obtained from BLANK and Standard Preparations and compute the Analyte Concentration in the Sample Preparation.

Calculate Exposure Level from Analyte Concentration as follows.

$$\underset{\text{(ppm)}}{\textbf{EXPOSURE LEVEL}} = \frac{1000(C)(V)(R)}{(DE)(M)(SR)(T)}$$

Where

C	=	**Analyte Concentration** (µg/ml)
V	=	**Volume of desorption solvent** (ml)
R	=	**Molar Volume @ 25°C** (24.45 l/mole)
DE	=	**De-Sorption Efficiency** (fraction of extraction) **for 2.0 ml CS_2**
M	=	**Analyte Molecular Wt** (g/mole)
SR	=	**Monitor Sampling Rate** (ml/min)
T	=	**Sampling Time** (min)

Personal Safety Division
3M Center, Building 235-2W-70
St. Paul, MN 55144-1000

3M PSD products are occupational use only.

In United States of America
Technical Service: 1-800-243-4630

Customer Service: 1-800-328-1667
3M.com/workersafety

In Canada
Technical Service: 1-800-267-4414
Customer Service: 1-800-364-3577
3M.ca/Safety

3M is a trademark of 3M. Used under license in Canada. © 2022, 3M. All rights reserved. Please recycle.