Validation of

Isopropyl Alcohol Using

SKC Passive Sampler Cat. No. 575-002

Research Report

Validation of Isopropyl Alcohol Using the SKC Cat. No. 575-002 Passive Sampler

Abstract

A sampling method using the Passive Sampler for Organic Vapor (Cat. No. 575-002) has been validated for sampling isopropyl alcohol in workplace air. A desorption efficiency (DE) study was conducted at 0.05, 0.10, 0.50, 1, and 2 times 100 ppm for an 8-hour period. The average DE was 103.5% with a relative standard deviation (RSD) of 4.0%. The sampling rate was determined for samplers exposed to isopropyl alcohol levels of 100 ppm at 80% relative humidity (RH) and 25º C. The mean sampling rate for 27 tests was 18.42 ml/min with an RSD of 4.6%. Samplers can be stored at ambient temperatures or in a freezer (-22º C) up to 3 weeks with less than a 5% loss in recovery. The Cat. No. 575-002 sampler was desorbed in 2 ml of 10% 2-butanol in carbon disulfide and analyzed by gas chromatography with flame ionization detection (FID).

Authors

Nicole Zovack
Cynthia Kuhlman
Linda Coyne

Validation Date: April/May 2012

Introduction

Isopropyl alcohol, also known as isopropanol and 2-propanol, is a flammable liquid with an odor resembling that of a mixture of ethanol and acetone (1). Potential symptoms of overexposure are irritation of eyes, nose, and throat; drowsiness, dizziness and headache; and dry cracking skin. It is used in antifreeze compositions, quick drying inks, and hand lotions as well as in the manufacturing of acetone and as a solvent for gums. Isopropyl alcohol is also used as an antiseptic (1). It has an OSHA and NIOSH guideline of 400 ppm and an ACGIH guideline of 200 ppm based on an 8-hour TWA.

The purpose of this study is to validate the Cat. No. 575-002 diffusive samplers for monitoring isopropyl alcohol at 100 ppm. Critical parameters include analytical recovery, sampling rate, and storage.

Experimental

The desorption efficiency for the samplers was conducted by injecting a known amount of isopropyl alcohol into the back of each sampler. The samplers were capped and allowed to equilibrate overnight and then analyzed the next day to determine the analytical recovery. The tests were conducted at mass loadings equivalent to an 8-hour TWA sample based on a calculated sampling rate (17.8 ml/min) at 0.05, 0.10, 0.50, 1, and 2 x PEL under dry conditions.

Isopropyl alcohol (Aldrich, St. Louis, MO, U.S.) was used to prepare concentrations in the test rig. A dynamic atmosphere was generated using a syringe pump and filtered air streams to generate the concentration. The system is shown in Figure 1. The atmosphere was fed into an exposure chamber. The diffusive samplers were exposed on a rotating bracket inside the chamber to simulate wind velocity. The sampling rate was conducted at 100 ppm for periods from 15 minutes to 8 hours at 80% RH and 25º C. The concentration within the atmospheric chamber was verified with SKC Cat. No. 226-01 sorbent tubes (SKC Inc., Eighty Four, PA U.S.) to be 90.3 ppm. The Cat. No. 575-002 diffusive samplers (SKC Inc., Eighty Four, PA U.S.) were used for the study. After exposure, samplers were sealed until analysis.

The storage study consisted of injecting 21 samplers with known amounts of isopropyl alcohol. The samplers were capped and allowed to equilibrate overnight. Three samplers were analyzed the next day while 9 samplers were stored at ambient temperatures and the remaining 9 samplers were stored in a freezer (-22º C). Three samplers were analyzed each week for 3 weeks from both temperatures to determine the analytical recovery.

All diffusive samplers were desorbed in 2 ml of 10% 2-butanol in carbon disulfide and shaken on a flatbed shaker for 15 minutes. The extracts were then analyzed by flame ionization detection gas chromatography. A chromatogram is shown in Figure 2.

SKC constantly reviews this data and conducts experiments to provide the most precise sampling rate. The rate published in these validation reports is the correct rate.

Results and Discussion

The desorption efficiency results for isopropyl alcohol with the diffusive samplers are shown in Table 1. The mean recovery of the diffusive samplers was 103.5% (RSD 4.0%). The sampling rate data is shown in Table 2. The results of the 27 samplers show that isopropyl alcohol can be sampled with the Cat. No. 575-002 diffusive samplers at an average sampling rate of 18.42 ml/min (RSD 4.6%). The data indicates that the sampler can collect a 15-minute to 8-hour sample at 100 ppm isopropyl alcohol. The 3 week storage study, shown in Table 3 and Table 4, suggests that the samplers are able to be stored at either freezer (-22º C) or ambient temperatures for 3 weeks with less than a 5% loss in recovery.

Conclusion

Cat. No. 575-002 diffusive samplers have been partially validated for sampling isopropyl alcohol with a DE of 103.5% (RSD 4.0%) and a sampling rate of 18.42 ml/min (RSD 4.6%). The samplers showed good stability when stored for 3 weeks at ambient and freezer (-22º C) temperatures. The Cat. No. 575-002 diffusive samplers can be used for measuring exposures to isopropyl alcohol from 15 minutes to 8 hours.

References

1. *Merck Index*, 13th Edition, p. 932.

Table 1. Desorption Efficiency
Isopropyl Alcohol

PEL	Spike (µg)	Recovered (µg)	Recovery (%)
0.05	109.51	108.90	99.4
		109.37	99.9
		107.53	98.2
		115.61	105.6
0.10	215.76	222.48	103.1
		220.18	102.0
		211.13	97.9
		217.97	101.0
0.50	1146.52	1195.71	104.3
		1221.99	106.6
		1114.02	97.2
		1133.46	98.9
1.00	2130.23	2273.79	106.7
		2267.43	106.4
		2324.05	109.1
		2306.55	104.7
		2197.76	99.8
		2393.31	108.6
		2339.63	106.2
2.00	4296.78	4720.89	109.9
		4654.94	108.3
		Mean	103.5%
		Std. Dev.	0.041
		RSD	4.0%

Table 2. Sampling Rate
100 ppm Isopropyl Alcohol, 80% RH and 25º C

Time (hr)	Sampling Time (ml/min)
0.25	18.39
0.25	18.74
0.25	18.97
0.50	18.34
0.50	18.42
0.50	19.32
0.50	18.12
1.00	18.48
1.00	18.56
1.00	19.97
1.00	18.65
2.00	18.99
2.00	19.76
2.00	19.65
2.00	19.70
4.00	17.84
4.00	17.49
4.00	18.44
4.00	18.89
4.00	18.44
4.00	17.90
4.00	16.78
4.00	17.45
8.00	17.10
8.00	17.94
8.00	17.15
8.00	17.74
Mean	18.42 ml/min
Std. Dev.	0.842
RSD	4.6%

Table 3. Storage Study
Isopropyl Alcohol, Ambient Temperatures

Week	Recovery (%)
1	101
2	97
3	105

Table 4. Storage Study
Isopropyl Alcohol, Freezer Temperatures

Week	Recovery (%)
1	103
2	99
3	102

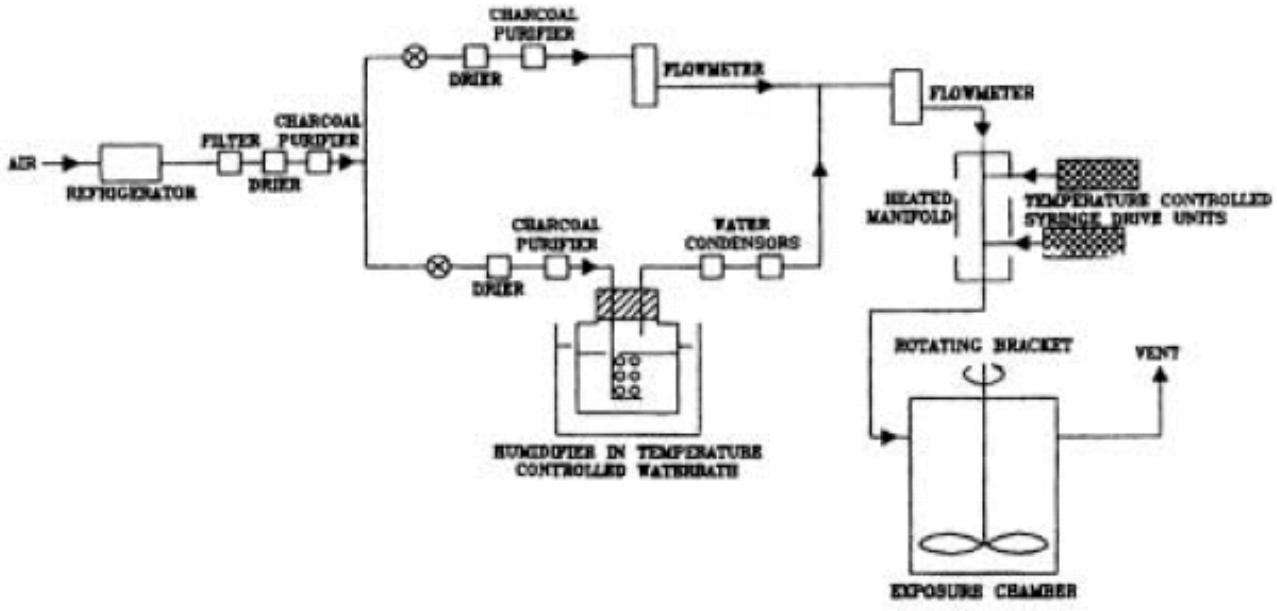

Figure 1. Test System

Appendix A

Atmosphere Generation Apparatus

The instrument is designed to expose a known concentration of a chemical hazard to a passive sampler under controlled conditions of: 1. Concentration, 2. Temperature, 3. Humidity, 4. Wind Velocity Effect, and 5. Time.

Description

The instrument consists of:

1. An exposure chamber in which the wind velocity effects are controlled by internal rotating holders.
2. An air supply and purification train such that dry air is blended with saturated air under desired temperature conditions so as to provide air at a known flow and selectable humidity.
3. An injection system composed of a precision motor driven syringe in which the chemical hazard can be injected into the flow system and the temperature of the injector is closely controlled.
4. An electrical control system that controls the entire instrument operation.
5. The chamber concentration can be verified by either solid sorbent sampling tubes actively sampled or by gas analysis of the gas phase. The particular verification method used will depend on the analyte of interest.

Means are also included to check the relative humidity.

Figure 2. Sample Chromatogram
Isopropyl Alcohol

Column: RTX-5 30 m x 0.32 mm ID x 1.0 µm film

Temperatures

Column: 50° C, isothermal, hold for 3.5 minutes
Injector: 250° C
Detector: FID at 250° C

Retention Times

Isopropyl alcohol: 1.74 minutes
2-Butanol: 2.03 minutes
Carbon disulfide (CS_2): 2.57 minutes