APPLICATION BRIEF

Gas Chromatography

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Analysis of Impurities in Hand Sanitizers

Introduction

Ethanol, also known as ethyl alcohol, is one of the largest volume organic chemicals utilized in the manufacture of consumer products like household cleaners and personal care products. It is also a key chemical in industrial products like printing inks, adhesives, and sanitizers which have become central to the daily sanitation needs of humans around the globe. It is important to monitor the quality of ethanol used in these products to protect human and animal health. This application brief analyzes trace level impurities that can be found in ethanol as per United States Pharmacopeia (USP) guideline.

The first section of this note describes the analysis of USP grade Ethanol as per USP recommended conditions and procedures. The second section describes a modified procedure that produces excellent results with significantly improved data throughput and substantial reduction in laboratory sample preparation time.

Instrumentation

The PerkinElmer Clarus® 690 GC with integrated autosampler was used to perform these experiments. The Clarus 690 GC was configured with a capillary injector and dual wide range flame ionization detector (FID). A PerkinElmer Elite 624 and BAC-1 columns were installed in the injector via a two-hole ferrule or a "Y" splitter as shown in Figure 1. The GC conditions required for the analysis are listed in Table 1.

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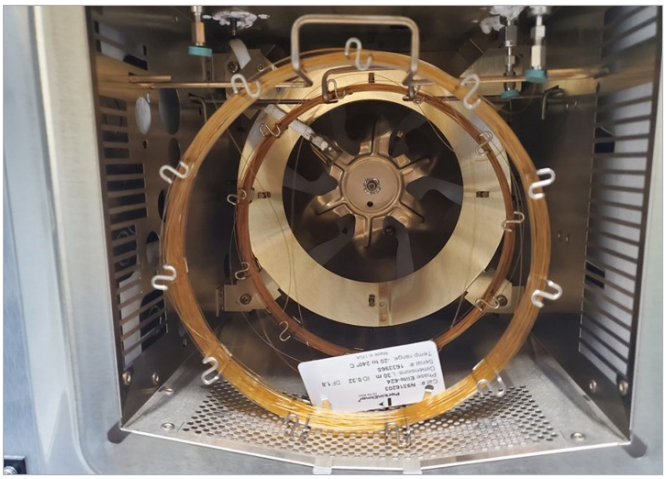

Figure 1: 30 m 0.32 mm Elite 624 and Elite-BAC columns used in this study.

Experimental

The GC conditions are found in Table 1.

Chromatography Conditions

Table 1: Chromatography conditions.

GC Parameters	
Instrument	PerkinElmer Clarus 690 GC
Carrier Gas	Helium
Columns	Elite-624 30 m 0.32 mm 1.8 µm N9316203
	Elite-BAC1 30 m 0.32 mm 1.8 µm N9315071
Column Pneumatics	Flow: 1 mL/minute Split: 50 mL/min
Autosampler Parameters	
Syringe Size	5 µL
Injection Volume	1 µL
Injection Speed	Normal
# of Plunges	8 times
Pre-washes	4
Sample Washes	2
Post Washes	2
Viscosity	5
Injector Parameters	
Injector	Type: S/S Temp: 240 °C
Detector Parameters	
Type	FID
Temperature	300 °C
Range	1
Att	-6
Hydrogen	30 mL/min
Air	450 mL/min
Data Rate	12.5 pt/sec
Oven Parameters	
Oven Initial Temperature	40 °C
Oven Initial Hold	5 minutes
Ramp Rate	30 °C/minute
Final Temperature	240 °C
Final Time	4 minutes
Oven Maximum	260 °C
Equilibration Time	0

Data Acquisition:

Data acquisition and data processing was performed using TotalChrom™ chromatography data system (CDS) software.

Sample Preparation

An aliquot of the Ethanol sample is added to a 2 mL autosampler vial and placed into the integrated autosampler of the Clarus 690 Gas Chromatograph (GC).

Standard Preparation:

Table 2. Preparation of standards.

Impurity	Std Conc.	Desired Conc.PPM	Final Vol.	Amt. Used µL
Acetone	999000	4400	25	110
1-propanol	999000	1000	25	25
Ethyl Acetate	999000	2200	25	55
2-butanol	999000	6200	25	155
IsoButanol	999000	21700	25	543
1- butanol	999000	1000	25	25
1-methyl-1- butanol	999000	4100	25	102.6
Amyl Alcohol	999000	4100	25	102.6

0.3 mL of the above standard was diluted in 10 mL of ethanol- and was run of the GC system.

Results and Discussion

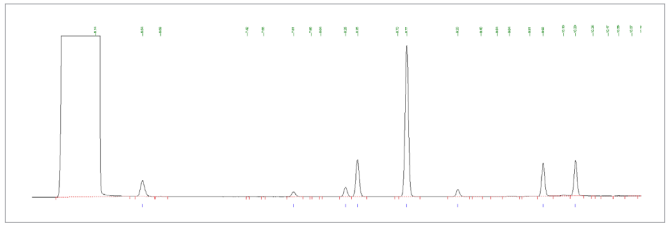

Figure 2: Impurity standard using 624 column.

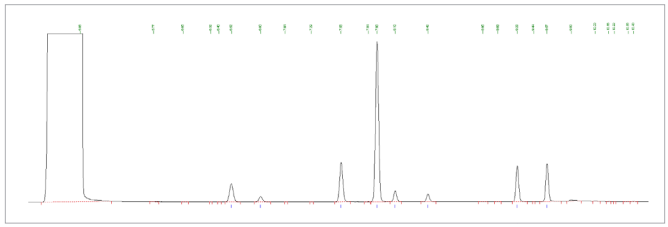

Figure 3: Impurity standard using BAC column.

Table 3. Impurities %RSD of Ethanol and IPA standards.

Ethanol	G43 Column	Confirmatory Column	Isopropanol	G43 Column
Compound	Precision % RS	Precision % RSD	Compound	Precision % RSD
Acetaldehyde	0.78	1.18	Ethyl Ether	1.95
Methanol	1.17	1.25	Acetone	1.69
Benzene	1.32	1.07	Diisopropyl	1.42
Acetal	0.97	1.03	1-Propanol	1.33
4-Methyl-2-Pentanol	0.92	0.96	2-Butanol	1.31

Summary

We have demonstrated excellent %RSD of impurities found in hand sanitizers utilizing both a G43 (624) and BAC-1 as the confirmation column. A short 10-minute analytical run time enables maximum laboratory productivity.

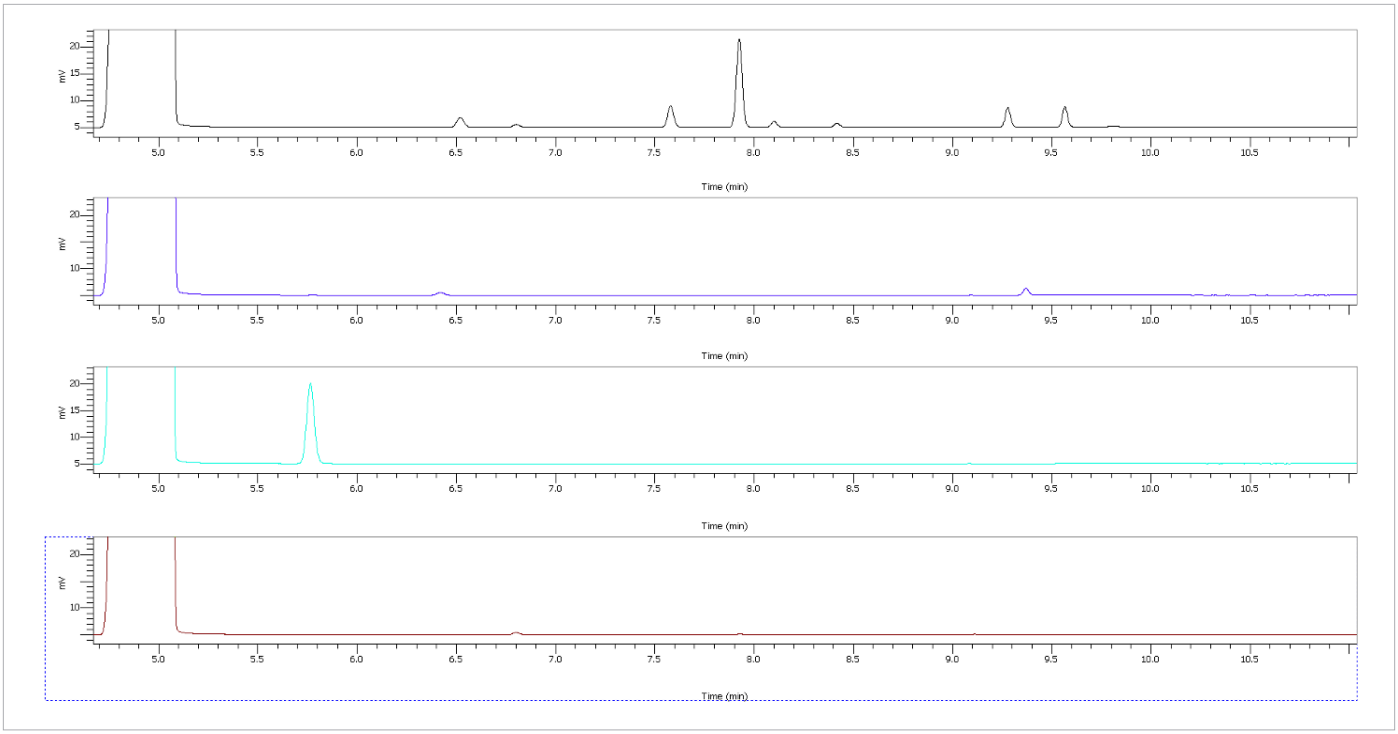

Figure 4: Stacked plot of standard and three locally purchased hand sanitizers.

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