

Quantification of Ethanol in Ethanol-based antiseptics

Introduction

When used in infectious disease control, the ethanol concentration in ethanol-based antiseptics used for hand sterilization should be between 70 and 83 percent by volume (vol%). Recently, as a temporary measure against the novel coronavirus, the use of 60 vol% has been allowed when ethanol is difficult to obtain. When it is necessary to use high-concentration ethanol products other than general antiseptics, they must be diluted with purified water prior to use. It is important to confirm the correct ethanol concentration for the diluted product.



Figure 1. FT/IR-4600 and ATR PRO ONE

FTIR spectroscopy is a fast and accurate analytical technique for quantitation of ethanol concentration in liquids. This application note reports the results for the analysis of ethanol concentrations in three commercially available ethanol-based antiseptics and a beverage grade alcohol that can be used for hand sterilization.

Keywords

Hand sanitizer, Covid, Ethanol, Antiseptic, FTIR, IR quantitation

Experimental

The ATR measurement was used without any sample pretreatment. Liquid samples are measured simply by placing a droplet on the prism. The analysis time per sample is approx. 4 seconds, and the ethanol concentration is reported automatically. Spectra Manager's "Simple Quantitation" option (Figure. 2) in the standard Spectra Measurement program allows quantitation and Pass/Fail judgment at the same time as measurement.

Measurement Conditions			
Main Unit	FT/IR-4600 (Figure 1)	ATR Prism	Diamond
Detector	DLATGS	Resolution	4 cm ⁻¹
Accessory	ATR PRO ONE (Figure 1)	Accumulation	4 (approx. 4 seconds)

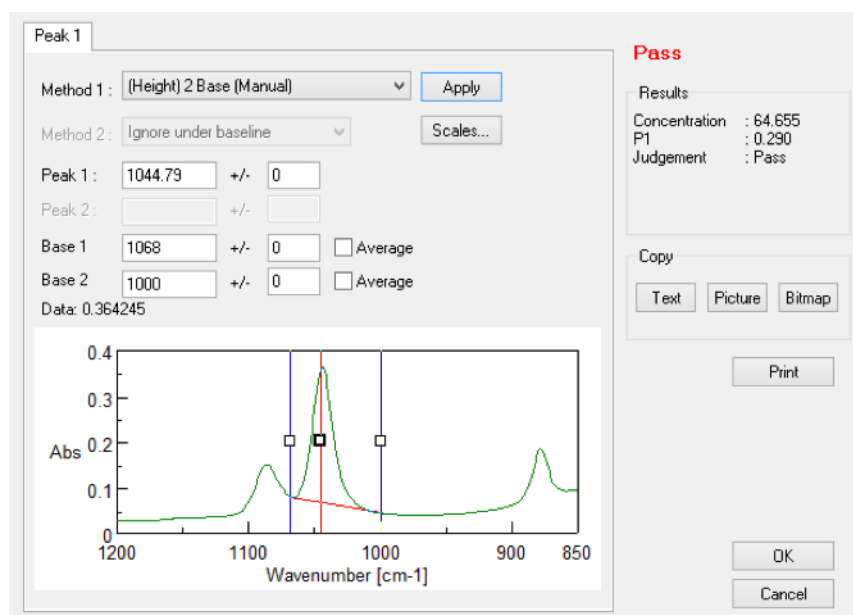


Figure 2. Simple Quantitation function in the Spectra Measurement program

Quantitation of ethanol concentration

Calibration curve

Standards from 0 to 99.5 vol% was prepared by mixing 99.5 vol% ethanol reagent with ultrapure water. The IR spectrum of 99.5 vol% ethanol is shown in Figure 3 (left). Figure 3 (right) also shows the calibration curve for the standard samples created at the peak height of 1045 cm⁻¹ attributed to the C-O stretching vibration.

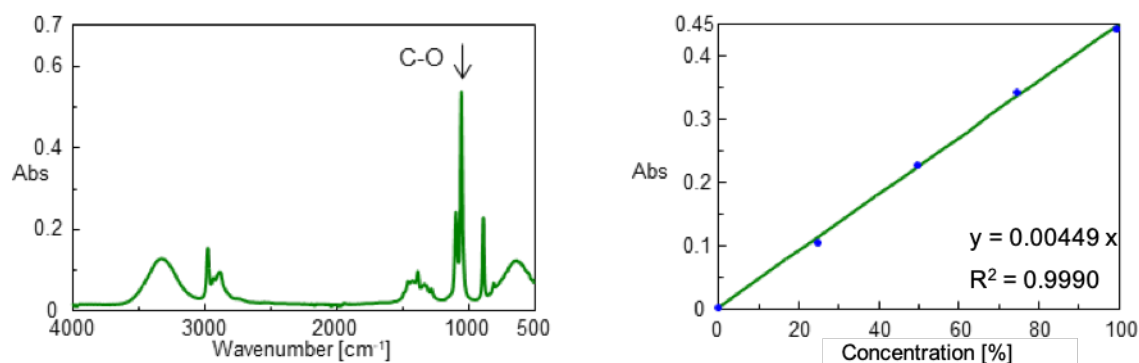


Figure 3. Simple Quantitation function in the Spectra Measurement program

Results

The ethanol concentrations of five samples: three commercially available antiseptics, a high concentration beverage alcohol, and as a reference, a Chinese liquor with a high alcohol concentration were measured. The following table shows the quantitation results and pass/fail judgment results. A concentration in the range 60 to 83 vol% was designated as “pass”. It was confirmed that the commercially available antiseptics and high-concentration beverage alcohol have concentrations that can allow them to be used as antiseptic for hand sterilization.

Table 1. Results and comparison of actual samples

Sample	Ethanol concentration quantitative results (vol %)	Pass/Fail
Ethanol-based antiseptic A	77	Pass
Ethanol-based antiseptic B	79	Pass
Ethanol-based antiseptic C	73	Pass
High concentration of alcohol for drinking	65	Pass
Reference: Chinese liquor	53	Fail

Conclusion

FTIR can be used to quantify not only the antiseptics, but also the ethanol concentration in alcoholic beverages². Using the same methodology, it can be used for quality control in pharmaceutical and food industries.

1 According to materials released by the Ministry of Health, Labor and Welfare, Japan

2 FT/IR Application Note 080-AT-0189

System Configuration	Model	Description	Part Number
Main Unit	FT/IR-4600	FT/IR Spectrometer	7084-J002A ³
Option	ATR PRO ONE	Single reflection ATR accessory	6909-J142A ⁴
	PKS-D1	Diamond crystal kit (High-Throughput Type)	6909-J341A ⁵
Software	QAU-4000	Quantitative analysis program	4880-0688A

3 FT/IR-4700 and FT/IR-6600/6700/6800 can also be used.

4 ATR PRO ONE VIEW is also available.

5 PKS-D1F is also available. When using ATR PRO ONE VIEW, PKS-D1V or PKS-D1VF should be used.