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Application News

FTIR / IRSpirit / QATR-S / Hand Sanitizer

No. AD-0223

Quick and Easy Analysis of Alcohol Content in Hand Sanitizer by FTIR Spectroscopy

❑ Introduction

If washing hands with soap and water are not readily accessible, hand sanitizer is the next alternative to prevent the spread of diseases and to kill germs. U.S. CDC have recommended sanitizers with 60–95% alcohol as the most effective composition of sanitizers. Additionally, with concerns over product fraud or fake substances used in the manufacturing of sanitizers, analysis of key active ingredients, such as alcohol, in sanitizers is crucial. This application news investigated the content of two most-commonly-used alcohol [ethanol and isopropyl alcohol (IPA)] in hand sanitizers. This analysis was conducted using Shimadzu FTIR spectrophotometer, IRSpirit^{TM}, equipped with an attenuated total reflection (ATR) accessory, QATR^{TM}-S which enables Fast and Easy set-up for quality testing.

❑ Experimental

Four commercially available alcohol-based hand sanitizers, two of which contains ethanol while the other two contains IPA, were analyzed (Table 2). Ethanol and IPA which were used to prepare the calibration standards were purchased from Merck, Germany, and Fisher Chemical, USA, respectively. The standard solutions, with concentration ranging from 0% to 100%, were prepared by dilution with Type E-1 ultra-pure water (Milli-Q® Millipore system, Germany). The samples were analysed without pre-treatment and dilution.

All standards and samples were measured using Shimadzu FTIR spectrophotometer, IRSpirit, equipped with an ATR accessory, QATR-S with a diamond crystal (Figure 1). The measurement conditions are shown in Table 1. About 20 to 30 µL of the sample amount was placed onto the ATR crystal using a micropipette and covered immediately with a volatile cover to minimize evaporation which could cause its concentration to change (Figure 2). The calibration curves of ethanol and IPA were generated using LabSolutions^{TM} IR Quantitation mode. For ethanol, the baseline was drawn at 1010 cm^{-1} and 1110 cm^{-1} and the calibration curve was created using the height from baseline to peak at 1044 cm^{-1}.

For IPA, the baseline was drawn at 1075 cm^{-1} and 1175 cm^{-1} and the calibration curve was created using the height from baseline to peak at 1127 cm^{-1}.

Table 1: FTIR Measurement Conditions

Instrument	:	IRSpirit™, QATR™-S (Diamond)
Wavenumber Range	:	4000 – 400 cm^{-1}
Resolution	:	4.0 cm^{-1}
Accumulation	:	25
Apodization function	:	Happ-Genzel
Detector	:	DLATGS

Fig. 1: IRSpirit^{TM} FTIR with QATR^{TM}-S

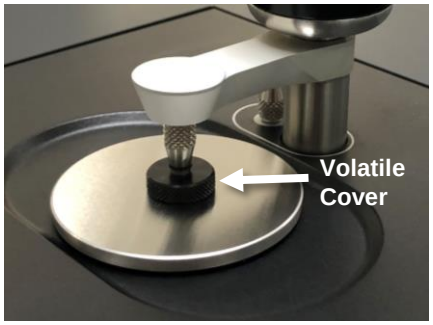

Fig. 2: QATR^{TM}-S with Volatile Cover

❑ Results and Discussion

Figure 3 shows the IR spectra of ethanol standards from 1140 cm^{-1} to 1000 cm^{-1} and IPA standards from 1200 cm^{-1} to 1060 cm^{-1} respectively. The IR spectra of alcohol-based hand sanitizers with 60% and 80% standards are shown in Figure 4. A good coefficient correlation (r^2) of more than 0.999 was obtained for the calibration curves of ethanol and IPA (Figure 5).

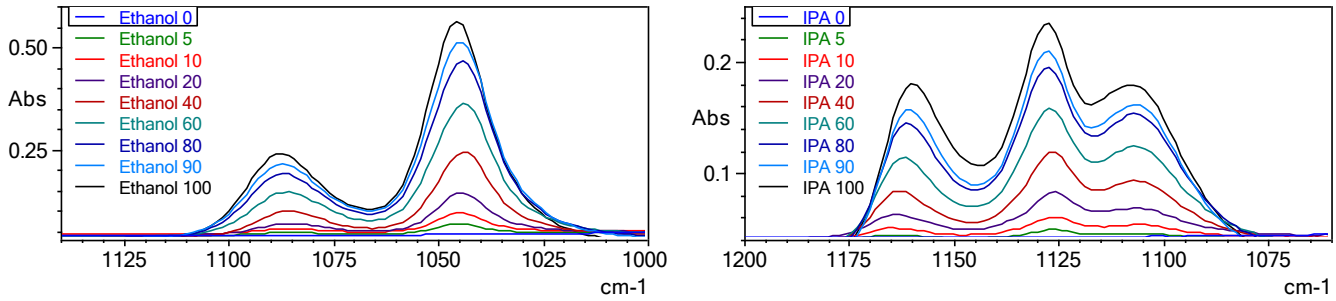

Fig. 3: IR Spectra of Ethanol Standards (left) and IPA Standards (right)

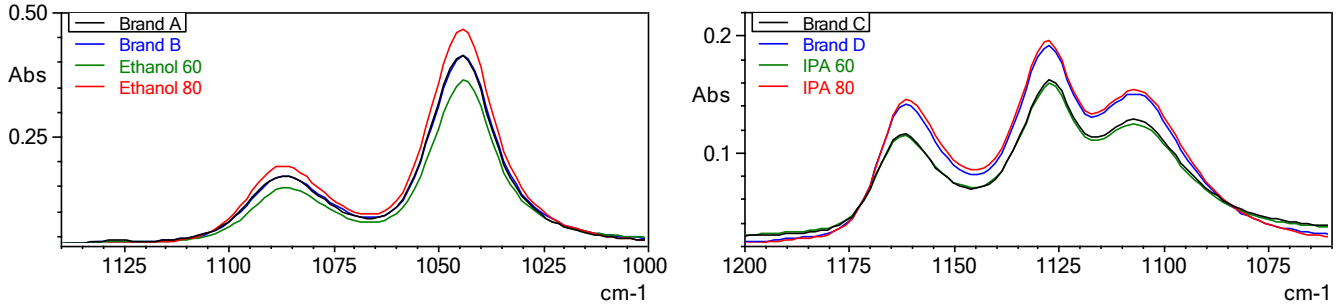

Fig. 4: IR Spectra of Brand A and B with 60% and 80% Ethanol Standards (left) and Brand C and D with 60% and 80% IPA Standards (right)

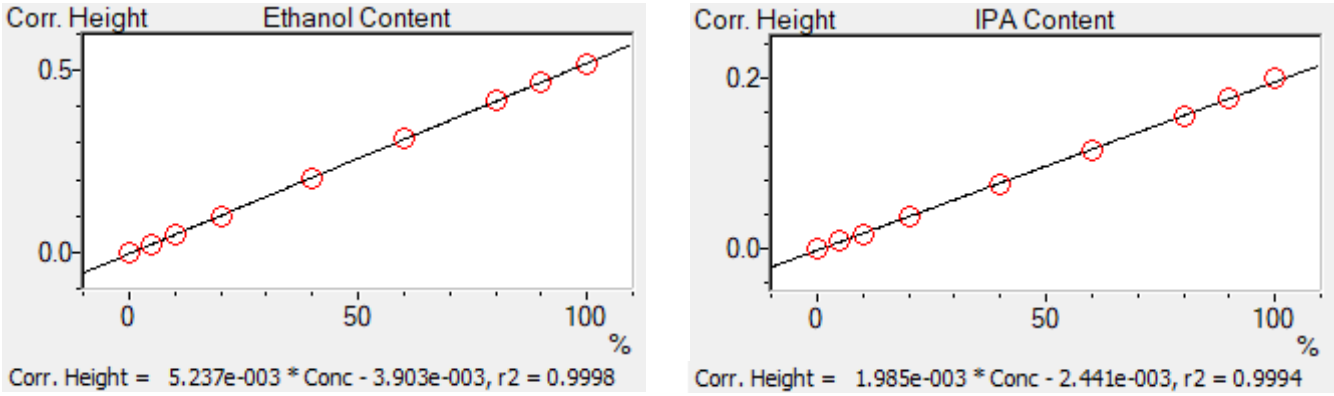

Fig. 5: Calibration Curves of Ethanol (left) and IPA (right)

Table 2 shows the quantitation results of the alcohol content in the alcohol-based hand sanitizers.

Table 2: Quantitative Results of Alcohol Content in Alcohol-based Hand Sanitizers

Sample	Type	Concentration	
		Labelled	Measured
Brand A	Ethanol	70 %	70.2 %
Brand B	Ethanol	66 %	69.4 %
Brand C	IPA	Not Stated	61.2 %
Brand D	IPA	> 70%	77.4 %

❑ Conclusion

With Shimadzu IRSpirit™ and QATR™-S, alcohol content in hand sanitizers are Easily and Accurately determined using just a single drop of sample.

❑ References

1. Todd ECD, Michaels BS, Holah J, Smith D, Greig JD, Bartleson CA. (2010) *Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 10. Alcohol-based antiseptics for hand disinfection and a comparison of their effectiveness with soaps*. Journal of Food Protection 73(11): 2128-2140.
2. Kampf G, Kramer A. (2004) *Epidemiologic background of hand hygiene and evaluation of the most important agents for scrubs and rubs.* Clinical Microbiology Reviews 17(4): 863-893.

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