

# Is There Proof That Your Hand Sanitizer is Effective?

## INTRODUCTION

Hand sanitizer gels contain multiple ingredients with ethanol or isopropanol as the primary active ingredient for antiseptic purposes. Hand sanitizer gels that are alcohol based have a recommended alcohol concentration of 60-95% to be considered effective.<sup>1</sup> Currently, shortages on hand sanitizer products have pushed companies who normally do not manufacture hand sanitizer products to start production. In order to ensure hand sanitizer products are being produced properly, the proper analytical tools for product investigation are necessary. Eurofins EAG Materials Science is equipped with the necessary tools and techniques to examine hand sanitizer gel products for their primary ingredients by Gas Chromatography with Mass Spectrometry (GC/MS) and Fourier Transform Infrared Spectroscopy (FT-IR). This note demonstrates the abilities that Eurofins EAG has to quickly and accurately screen hand sanitizer products to ensure these types of products meet the requirements for effectiveness.

## DISCUSSION

In this study, the objective was to screen five commercial hand sanitizer gels for their main ingredients by GC/MS and FT-IR. A list of the ingredients commonly found in hand sanitizers is shown

in the table below.

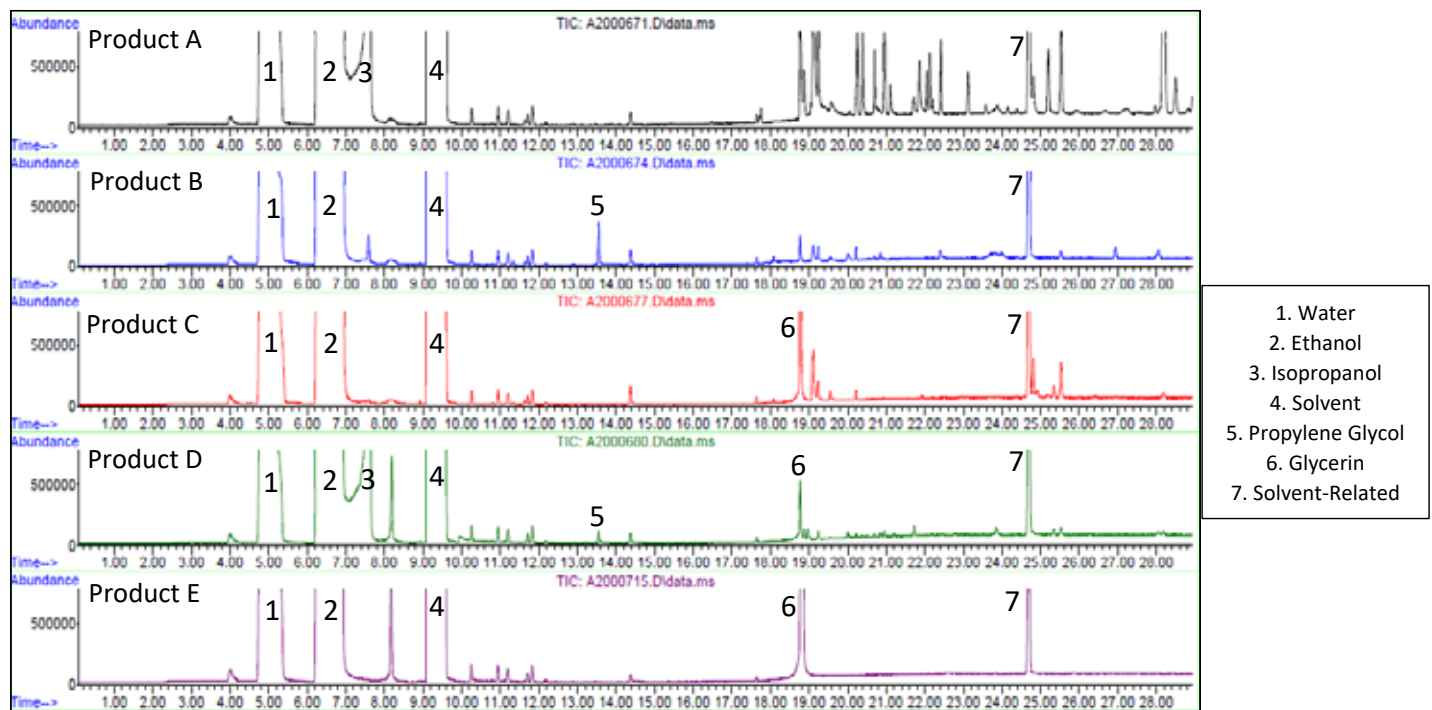
**Active Ingredient:** Ethanol

**Inactive Ingredients:** Water, Triethanolamine, Glycerin, Propylene Glycol, Tocopherol Acetate (Vitamin E Acetate), Carbomer, Isopropyl Myristate, Fragrance\*

Each common inactive ingredient in hand sanitizer gels serves a specific purpose. Water acts as a solvent and is necessary to allow the active ingredient alcohol to penetrate bacterial cells in order to kill them. Glycerin and propylene glycol are humectants to help prevent the loss of moisture in the skin. Isopropyl myristate is an emollient. Along with Vitamin E acetate, isopropyl myristate helps smooth skin. Carbomer is a thickening agent that causes the gel-like texture in hand sanitizers, and triethanolamine functions as a pH adjuster as well as promoting emulsification.

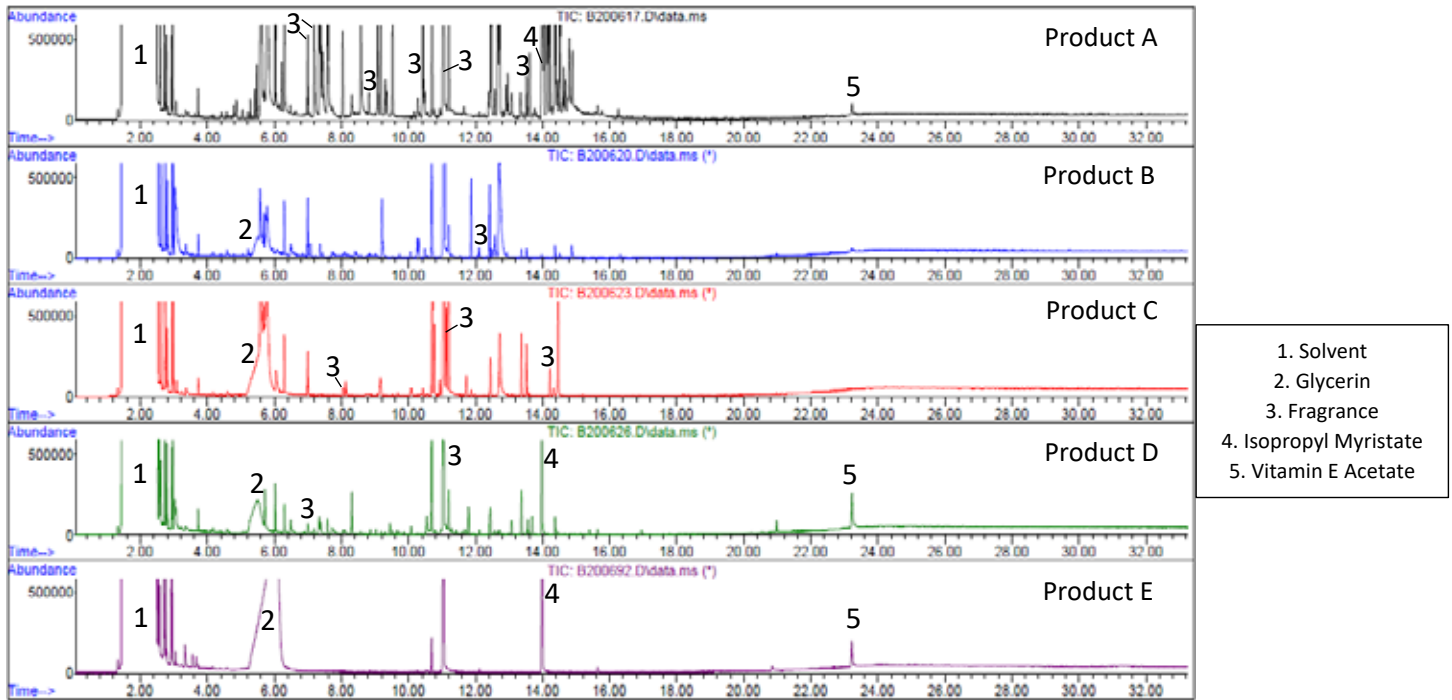
Two types of screening methods by GC/MS were utilized: 1) a volatile screening method for ingredients like ethanol, isopropanol and propylene glycol (see Figure 1) and 2) a semi-volatile screening method for ingredients like glycerin, Vitamin E acetate, and isopropyl myristate (see Figure 2).

Figure 1. Volatile Screen of Products A-E



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Figure 2. Semi-Volatile Screen of Products A-E



Additionally, besides qualitatively screening the samples, the ethanol and isopropanol content was quantified in all five of the samples by Gas Chromatography with Flame Ionization Detection (GC/FID) using an analytical reference standards for calibration. For the ethanol quantitation, Product D was fortified with a known amount of ethanol to assess accuracy and the spike recovery was observed to be 101%.

Table 1. Summary of Quantitative Results for Ethanol in Products A-E

Sample Description	Label Claim Ethanol Concentration (wt%) <sup>1</sup>	Determined Ethanol Concentration (wt%) <sup>1</sup>	% RSD <sup>2</sup>
Product A	68%	62.34%	0.92%
Product B	65%	67.39%	0.87%
Product C	62%	62.33%	0.90%
Product D	62%	60.48%	0.41%
Product E	70%	64.90%	1.13%

<sup>1</sup>wt % = weight percent; <sup>2</sup>Percent Relative Standard Deviation

Table 2. Summary of Quantitative Results for Isopropanol in Products A-E

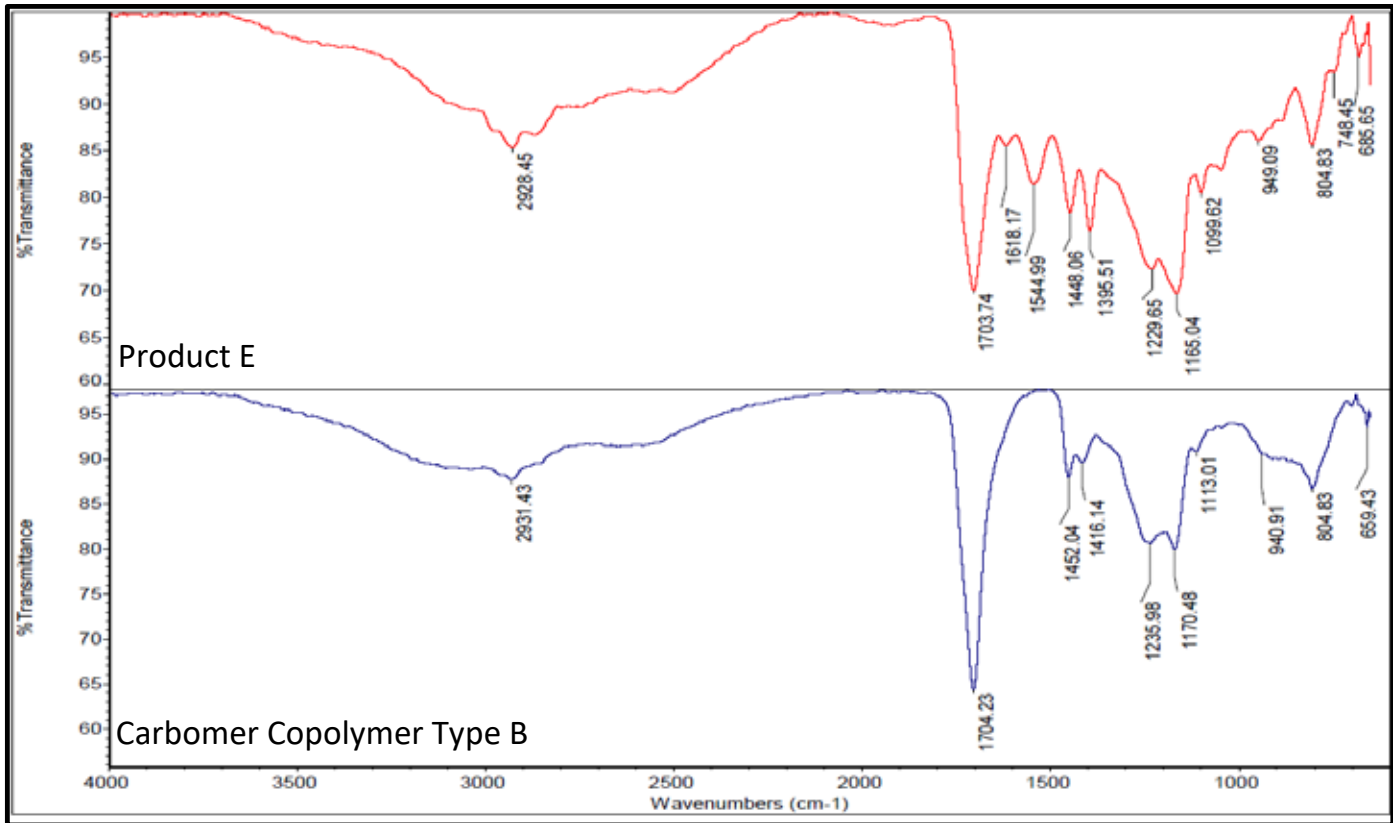
Sample Description	Determined Isopropanol Concentration (wt%) <sup>1</sup>	% RSD <sup>2</sup>
Product A	3.18%	1.56%
Product B	< 1%	N/A
Product C	< 1%	N/A
Product D	3.33%	0.80%
Product E	< 1%	N/A

<sup>1</sup>wt % = weight percent; <sup>2</sup>Percent Relative Standard Deviation

Not every ingredient in hand sanitizer gels can be analyzed by GC/MS. To elucidate the polymeric portion of hand sanitizer gels (i.e. carbomer or polyacrylic acid), a customized series of solvent extractions was performed to isolate the carbomer followed by FT-IR to confirm its presence. Figure 3 shows stacked FT-IR spectrum of Product E (red trace) and a carbomer standard (purple trace).

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Figure 3. FT-IR Stacked Spectra of Product E and Carbomer Copolymer Type B



Additionally, besides an FT-IR screen of Product E for carbomer, the carbomer content in this product was gravimetrically determined. Table 4 below summarizes these results.

Table 4. Gravimetric Determination of Carbomer

Carbomer Weight Percentage	Average	RPD <sup>1</sup>
0.173%	0.172%	1.2%
0.171%		

<sup>1</sup>Relative Percent Difference

## SUMMARY

In summary, many ingredients in hand sanitizer gel products can be identified through the combined techniques of GC/MS and FT-

IR. Additionally the levels of ethanol, isopropanol, and carbomer can be determined in these products. Accurately identifying and quantifying the main ingredients in hand sanitizer gels is critical for production when there is high demand for these products. Eurofins EAG has considerable experience in identifying ingredients in a variety of different hand sanitizer gel products to confirm the product label claim as well as determining whether these types of products meet the requirements for effectiveness.

## REFERENCES

1. Reynolds, S. A., Levy, F., & Walker, E. S. (2006). Hand sanitizer alert. *Emerging infectious diseases*, 12(3), 527–529. <https://doi.org/10.3201/eid1203.050955>