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APPLICATION NOTE

Testing Face Masks for Volatile Organic Compounds (VOCs)

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INTRODUCTION

Due to the recent COVID-19 global pandemic, there is a shortage in the supply of face masks for hospital staff, essential workers, and the general public. To meet the increased demand, mask manufacturers are rushing to increase the supply and new manufacturers are entering the market. However, several manufacturing hurdles including the stress of accelerated timelines and uncertainties due to the learning curve required for the mass production of an entirely new product, have led to apprehension regarding face mask safety and quality.

To address these concerns, EAG Laboratories is equipped with analytical methodology and instrumentation to evaluate a variety of different face masks for a class of chemicals known as volatile organic compounds (VOCs). VOCs in general, are organic compounds that readily evaporate at room temperature causing these compounds to be emitted as gases, which may present a toxicology risk for inhalation exposure.[1] Whether a particular compound is of toxicological concern depends upon the specific chemical identity or chemical class of the material as well as its concentration.

EAG's analytical team utilizes a customized approach in which the masks are sampled via thermal desorption and the volatile components are separated and identified by Gas Chromatography-Mass Spectrometry (GC-MS). Once the VOCs are identified, EAG engages its strategic partnerships with Toxicological Consultants to evaluate the list of VOCs to determine if any specific components are of toxicological concern, and if so, the threshold concentrations above which a material may be considered harmful. This information drives subsequent analytical experiments to compare the samples of interest with a standard of known concentration. This application note demonstrates EAG's ability to quickly and accurately perform an initial qualitative screen to generate a list of specific VOCs that could be evaluated for potential toxicological concern as part of a larger project.

DISCUSSION

In this study, the objective was to screen eight different face masks for VOCs by GC-MS using a customized approach in which the masks are sampled in their entirety (sans the ear loops) via thermal desorption. The samples consisted of the following different types of masks: a N95 mask (Product A), a KN95 mask (Product B), and six different surgical masks (Products C-H). The samples were heated to 50 °C for 1 hour and then sampled onto a Tenax® TA sorbent tube. Collection was performed at 100 mL/min for 10 minutes (1 L total) and at room temperature, 25 °C. The tubes were then analyzed using thermal desorption (TD) technique, followed by GC-MS. A list of selected VOCs detected throughout the group of different face masks is provided below.

1) 2-butoxy ethanol
2) C10 branched alkanes
3) C11 branched alkanes
4) C12 branched alkanes
5) butylated hydroxytoluene
6) halogenated hydrocarbons
7) toluene
8) hexanal

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Figure 1 and Figure 2 below display representative chromatograms for the eight face masks from this analysis.

Figure 1. VOC profiles of Products A-D

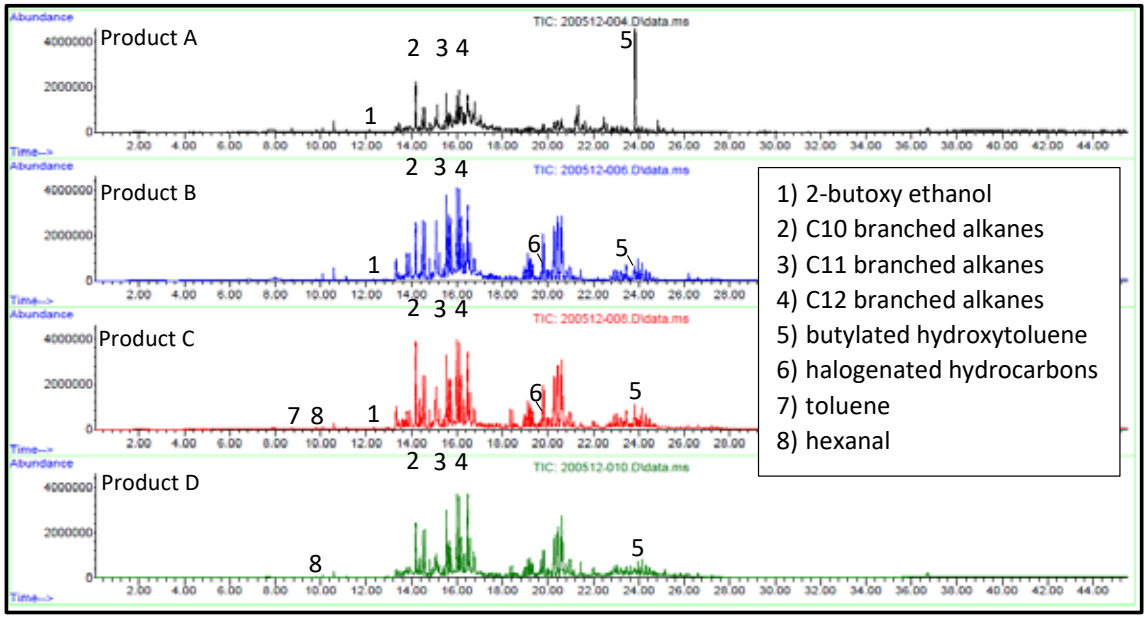
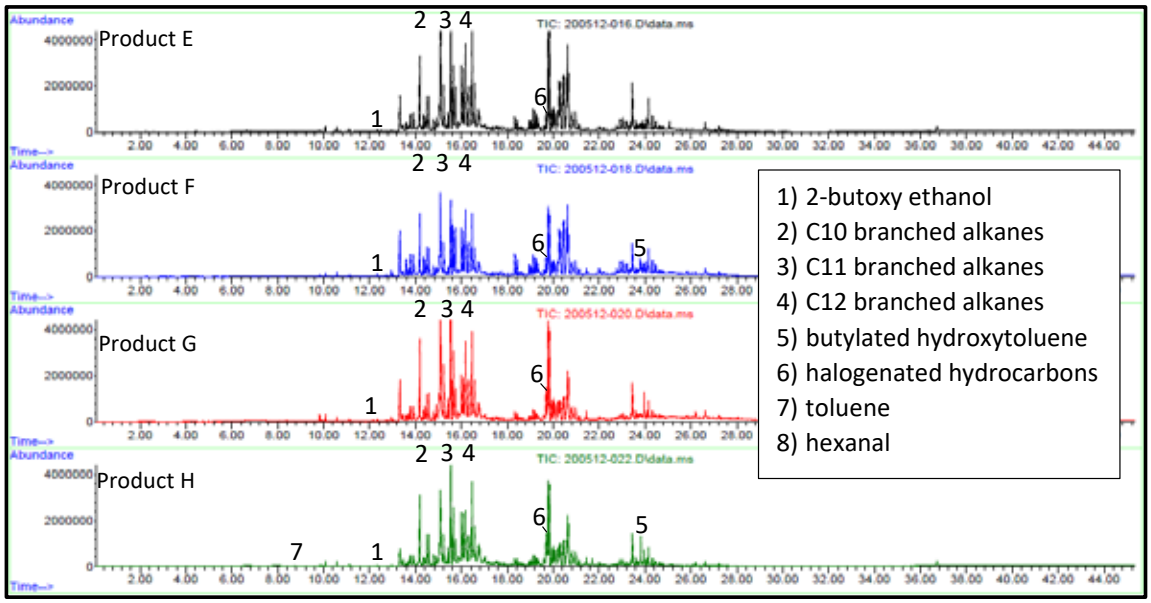


Figure 2. VOC profiles of Products E-H



SUMMARY

In summary, VOCs in face masks can be identified quickly and accurately using a thermal desorption sampling technique with GC-MS. Once identified, the list may be evaluated by a toxicologist to determine if any specific component may be of toxicological concern. If there are chemicals of concern present, the toxicologist can provide threshold limits for exposure and additional experiments can be performed to determine if the chemicals present are above or below these limits. This multi-step approach is able to provide meaningful context to laboratory results that will help manufacturers objectively assess whether a product new to the market exhibits safety concerns.

FOOTNOTES

[1]Anand, S.S., Philip, B.K., Mehendale, H.M. Volatile Organic Compounds, Encyclopedia of Toxicology (Third Edition); Academic Press: Amsterdam, 2014.