A better approach to assessing and monitoring aromas and odors

Historically, there are two basic approaches for assessing and monitoring aromas and odors neither of which is guaranteed to provide adequate information to solve a problem.

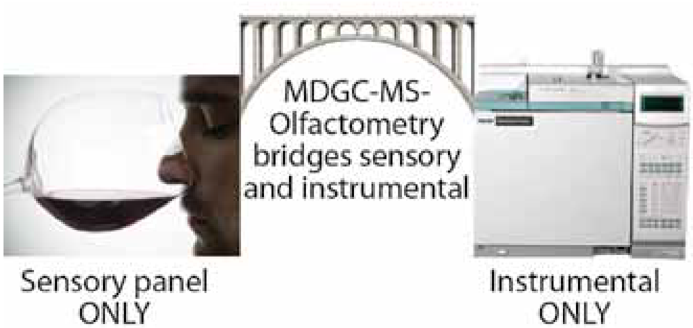

Illustration 1.

As shown in the Illustration 1, the two extremes reflect (1) the human sensory panel ONLY and (2) the instrumentation ONLY approach to odor assessment and monitoring, however, there are actually three possible approaches.

With respect to the sensory only approach, there are those who believe that, because of the complexity of the human olfactory response, only human 'sensors' are equipped to assess human sensory impact.

The limitation of a sensory panel is, that while it can identify and classify aromas and odors for those compounds whose concentrations are above their odor thresholds, they may not be able to identify the compound.

Within the instrument only approach, there are those who believe that, given enough analytical or statistical computational power - an instrumentation approach can be used for routine odor assessment or crisis driven problem solving.

The limitation of the instrument only approach is that standard Mass Spec Detectors are not set up to detect compounds below the levels indicated in Tables 1 and 2.

MultiDimensional Gas Chromatography- Mass Spectrometry-Olfactometry (MDGC-MS-O) forms a 'bridge' between the two extremes. This is a combined instrument and olfactory approach which identifies both the compound and the aroma or odor simultaneously and then uses the human sensory assessment to direct the subsequent critical instrument correlations.

This approach has emerged from the successful execution of hundreds of such odor quality investigations since 1995. Utilizing this approach, all investigations begin with sensory assessment of contrasting representative samples ('acceptable' versus 'unacceptable') in order to identify the odor causing compounds. After identification, these compounds can be translated to targeted instrument alternatives for subsequent problem solving or routine QC monitoring.

One important concept associated with aroma/odor analysis is the odor threshold concentration. This is the concentration at which the majority of people will sense an odorous compound. For comparison, the odor threshold concentrations for a number of compounds which might be familiar to many people are shown here in Tables 1 and 2.

Compound	Odor Threshold (ppm)
Acetone	42
Isopropyl Alcohol	26
Ammonia	1.5
Ethanol	0.52
Methyl Ethyl Ketone	0.44
Hydrogen Sulfide	0.00041
Isovaleric Acid	0.000078
p-Cresol	0.000054
Diacetyl	0.000050
Geosmin	0.0000065
Tribromoanisole	0.000000030

Table 1. Odor threshold concentrations for selected compounds. The red line indicates the detection limit of the instrument ONLY approach when the instrument is operated in a

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survey mode. The compounds in both the white green sectors can be detected and identified using MDGC-MS-Olfactometry.

Low impact odorant compounds are represented by large odor threshold concentrations. As the odor threshold concentration decreases, the odorant impact increases. The last compound in table 1, tribromoanisole (TBA), is characterized by a musty, moldy odor. As you can see from these tables odor threshold concentrations among compounds can vary by orders of magnitude. An individual will be able to smell the compounds with extremely low threshold values long before they can be measured instrumentally using the instrument ONLY approach.

As an example, recently, individuals were able to detect a musty odor in a pharmaceutical product which was then subjected to a total recall. Samples were sent to 5 labs none of which were able to identify the odor causing compound using standard Mass Spec Detectors. Within hours, a lab using MDGC-MS-Olfactometry detected and identified the compound as TBA with an odor threshold of 30 parts per quadrillion.

Compound	Descriptor	Odor threshold (ppm)
Ethanol	Sweet, alcohol	0.52
Menthol	Minty-cool, fresh, sweet	0.52
Benzaldehyde	Artificial almond oil, fruity, cherry like	0.042
d-limonene	Fruity, citrus	0.038
alpha-pinene	Woody, piney, herbal, turpentine-like	0.018
Raspberry ketone	Raspberry, sweet	0.010
Acetic acid	Sour, acidic, sharp	0.006
acetaldehyde	Sweet, sharp	0.0015
Decanal	Sweet, fruity, citrus, orange	0.0004
Cinnam aldehyde	Pungent, cinnamon	0.00036
n-nonanal	Fresh, medicinal, solvent	0.00034
Diacetyl	Sweet, buttery	0.00005
Ethyl butyrate	Sweet, fruity, fresh	0.00004
n-octanal	Fresh, citrus, fruity	0.00001
Vanillin	Vanilla	0.00000012

Table 2.
Aroma threshold concentrations for selected flavor compounds. The red line indicates the detection limit of the instrument ONLY approach when the instrument is operated in survey mode. The compounds in both the white and green sectors are detectable and identifiable using MDGC-MS-Olfactometry.

This picture shows a scientist or 'olfactory detector' working at the 'sniff' port performing the olfactometry analysis. The sniff port is connected to the end of a second column within a specially fitted gas chromatograph using an open split interface which directs the effluent to both the sniff port and the mass spectrometer detector. The scientist utilizes a specialized record keeping software package called AromaTrax™ which allows the user to quickly describe or characterize the aroma /odor events as they are sensed at the sniff port.

To understand more about this method of assessing and monitoring aromas and odors contact:
Volatile Analytics.

Testing services utilizing MDGC-MS-Olfactometry are available by contacting Volatile Analytics.

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