

Odor Masking

Description: A study to investigate and determine the primary conditions that could cause changes in perception or intensity of odor that comes from odorant that is added to methane to mark its presence

Status: Phase I psychophysical test program is ongoing and showing significant findings. The project team is working closely with contractor on protocols and chemical pairs, compounds and mixtures to be tested.

BENEFITS

The industry could benefit by having a scientific basis for understanding the causes and mitigation measures to eliminate cases of Odor Masking. Currently, cases of odor masking are very infrequent but in order to be proactive and ready for changes that are anticipated with use of a wider range of gas compositions, NYSEARCH members are working to gain both a qualitative and quantitative basis for addressing odor masking.

BACKGROUND

Odor masking is the change in PERCEPTION (psychophysical response) to odor rather than an actual disappearance of odor (which is known as Odor Fade and is the subject of a separate GTI/OTD project). Given that odorization is performed to enhance safety and help customers understand the presence of a natural gas leak, odor masking has important safety concerns.

Odor Masking is not well understood and it may be that scientists are not in full agreement as to its causes. In the Cardiff University proposal selected through a NYSEARCH Request For Proposal process, Dr. Tim Jacob, an expert on olfaction defines odor masking in three ways: 1) one odor overwhelming another with total intensity remaining the same or increasing, 2) one odor reducing the perception of another with the overall intensity decreasing to an intermediate level, referred to in the proposal as antagonism, and, 3) one odor reducing the odor in a mixture to below the intensity of either odor individually.

The vision for the overall NYSEARCH program in this area consists of three phases of work with Phase I focused on identifying the causes of odor masking and the constituents involved. Phase II envisions development of a specific and more refined list of odor masking agents and Phase III targets the operator goal which is to enhance safety by using results from Phase I and II to develop guidelines that mitigate odor masking. In discussions with funders of the Phase I project, it was highlighted by some member participants that odor masking questions could become more prevalent based on introduction of new gas supplies and more diverse trace constituents coming from different gas production processes and supplies.



Figure 1: Sample Sniff Test in Cardiff Lab

TECHNICAL APPROACH

The goals of Phase I are to study and specifically define the basis for odor masking that is unique to the gas industry's use of mercaptans and to measure the degree of masking that occurs. The contractor differentiates the Phase I work as a "psychophysical approach" rather than a quantitative and cognitive study. In Phase I, Cardiff University team members are conducting systematic testing on numerous sponsor-driven chemical pairs using a panel of randomly-selected human assessors. Using a visual-analog scale that does not require cognitive assessment by the volunteer, as illustrated in the Figure 2, the subject will evaluate the intensity and hedonics (pleasantness) of separate components of "conjugate pairs" (chemicals of interest that are suspected to cause one of the three types of masking listed above), counteracting agents and selected thiols (the name for the compound class



Figure 2: Sample Chemical Pair Test Setup

that mercaptans belong to). This testing will be used to eliminate un-related chemicals/causes and pare down the list that characterizes chemicals in the gas industry odorization environment that create odor masking.

Phase I is targeted to: 1) expand scientific research for our specific application and would deliver qualitative data for at least (12) selected conjugate pairs including selected natural gas constituents, 2) establish the degree of compensation or additive sum (complex mixture) of two chemicals that overwhelms an individual odorant, 3) determine the degree to which complex odorant mixture can inhibit perception of thiols, and, 4) provide a list of compounds that mask mercaptans. It is noted that to come up with a quantitatively precise list, additional

quantitative and sensory testing on the human olfactory system is anticipated.

PROGRAM STATUS

Project testing is underway with randomly, selected human subjects. Illustrations of simple test setups have been provided (see example in Figure 1). An illustration of initial results is shown in Figure 3.

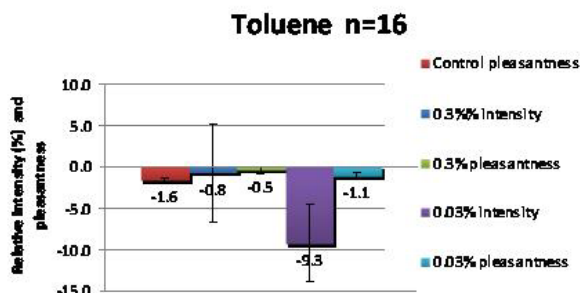


Figure 3: Sample Raw Results for Chemical Pair Toluene with Ethyl Mercaptan

The funding group is prioritizing all the preferred tests as initial project results are discussed. Cardiff has established a reliable test process in conjunction with gas industry experts who are familiar with field odorization practices, gas trace constituents and some infrequent situations where it is suspected that odor masking has occurred.

The three types of odor masking will be explored. The group is also discussing classes of trace constituent components and categories for odor quality assessment. Panels of tests on multiple chemical pairs will continue to take place using a rigorous routine and very clean test environment. Phase II discussions will ensue in 2012 following completion of Phase I testing.

Highlights

- Psychophysical testing with random volunteers is progressing with repeatable results
- Instances of odor masking have been demonstrated with ranges of chemicals and concentration levels

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