

Technology Brief

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 complete and had important findings that are now being further investigated through Phase II quantitative tests. The project team is working closely with contractor on protocols and getting interim test results to understand the basis for the odor masking mechanisms and to determine next steps for eliminating any confirmed mechanisms.

BENEFITS

The industry needs a better understanding of 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 to odor rather than an actual disappearance of odor (which is known as Odor Fade and is the subject of other work in the industry). 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 targets 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 industry experts and project participants, odor masking questions have become more prevalent based on introduction of new gas supplies and more diverse trace constituents coming from different gas production processes and supplies.

TECHNICAL APPROACH

The goals of Phase I were 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 completed 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, numerous subjects evaluated 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 that mercaptans belong to). This testing was 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. Several of the chemicals that were tested are present in new gas supply or gas production processing.



Figure 1: Sample Sniff Test in Cardiff Lab



Figure 2: Sample Chemical Pair Test Setup

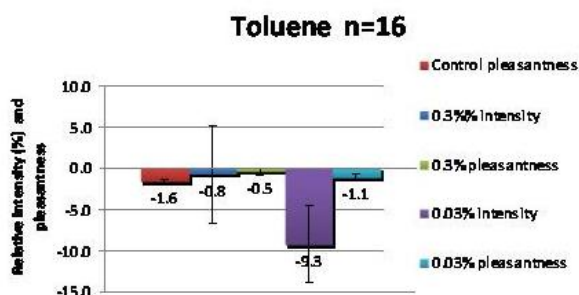


Figure 3: Sample Raw Results for Chemical Pair Toluene with Ethyl Mercaptan

PROGRAM STATUS

The current Phase II is aimed at identifying the mechanism and location of “masking” using electrophysiological techniques (Electro Encephalo Gram or EEG). Specifically, Cardiff is investigating all four potential masking mechanisms identified in Phase I and determining how and where that masking is occurring in the olfactory system. Phase I qualitative testing on randomly selected test subjects was completed and fully reported on to funders in the early 2012. An illustration of simple Phase I test setup is shown in Figure 2. Illustrations of sample intensity and ‘hedonics’ (pleasantness) measures are shown in Figure 3.

Highlights

- Psychophysical testing with random volunteers has shown statistically significant and repeatable results
- Instances of odor masking have been demonstrated with ranges of chemicals and concentration levels
- Phase II quantitative test protocols are established and are producing initial results that are similar to Phase I qualitative tests

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