
PROVEN APPROACHES TO INVESTIGATING AND SOLVING AIR QUALITY PROBLEMS



CASSEN Testing Laboratories

ODOUR-RELATED PROBLEMS

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Air quality problems encountered in different environments (e.g. ambient, indoor & industrial) can be very different in nature or can be very similar. For example, occurrences of odours, which play a major role in most air quality complaint cases, can originate from any of these environments from similar or widely different volatile organic compounds (VOCs). Through many years of extensive research, CASSEN Testing Laboratories has developed various techniques to characterize odour-related air quality problems attributed to volatile organic compounds. Examples of various odour-causing air quality problems are shown throughout this newsletter.

Typical Air Quality Problems Faced by OH&S Professionals

Odour complaints including transient odour

Health Complaints:

- Eye, throat and skin irritations
- Headaches
- Allergic reactions

Bad air quality complaints due to VOCs released:

- From new or contaminated building materials, new furnishings, mould growth, occupant activities, etc.
- Into the workplace through various industrial processes, commercial & other activities
- Into ambient air from industrial processes, commercial & other activities

Migration of VOCs into buildings through:

- Contaminated soil from chemical spills
- Building on contaminated waste sites

Official Methods

1. EPA Method 17 - Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes

2. ISO 16017-1 - Sampling and Analysis of Volatile Organic Compounds in Indoor, Ambient and Workplace Air by Sorbent Tube/Thermal Desorption/Capillary Gas Chromatography - Pumped Method

3. ISO 16017-2 - Indoor, Ambient and Workplace Air - Sampling and Analysis of Volatile Organic Compounds by Sorbent Tube/Thermal Desorption/Capillary Gas Chromatography - Diffusion Method

4. ASTM Method D-6196-97 - Standard Practice for Selection of Sorbents and Pumped/Thermal Desorption and Analysis Procedures for Volatile Organic Compounds in Air

5. NIOSH Method 2549 - Volatile Organic Compounds Screening using Multi-Bed Sorbent Tubes, Thermal Desorption, Gas Chromatography and Mass Spectrometry

VARIOUS AIR QUALITY PROBLEMS SOLVED BY CASSEN TESTING LABORATORIES

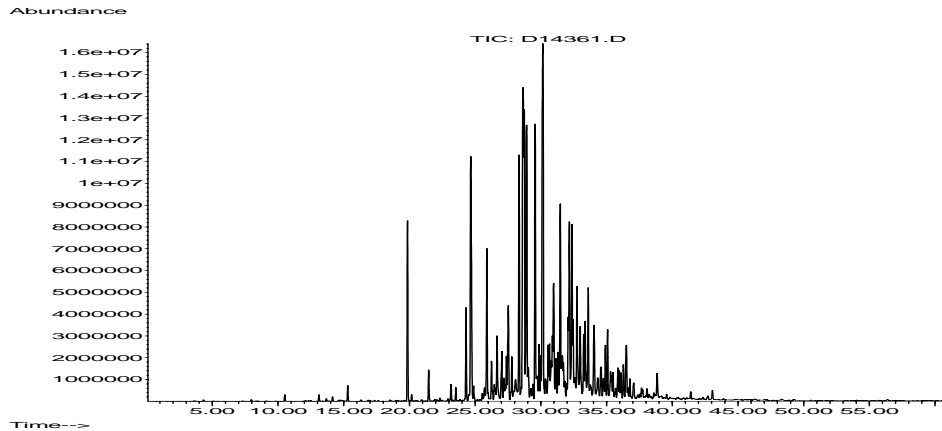
The following examples have been chosen to highlight the diverse applications and power of the open characterization technique for solving air quality problems. The samples discussed were analyzed using the adsorption/flash thermal desorption technique coupled with gas chromatography/mass

spectrometry in accordance with a number of referenced methods. Typically, samples submitted include indoor and outdoor air samples, industrial plant air, bulk materials, exhaust emissions and industrial process emissions. The technique is highly useful in

identifying a number of air quality problems such as:

- Odour problems
 - Health concerns
 - Industrial emissions
 - Routine monitoring
 - Process characterization
 - Bulk material emissions
-

IDENTIFICATION OF ODOURS EMITTED FROM A WASTE TREATMENT PLANT



The above sample was taken from a municipal wastewater treatment facility where offensive odour was observed in the aeration basin during sludge treatment. Many odorous compounds were detected in this area, including volatile fatty acids, organic sulphides, amines, phenolic compounds and

aldehydes. Other compounds found included aromatic and aliphatic hydrocarbons, chlorinated compounds and ketones. Odour in this location was apparently caused by the combination of many classes of organic compounds including those with very low odour thresholds.

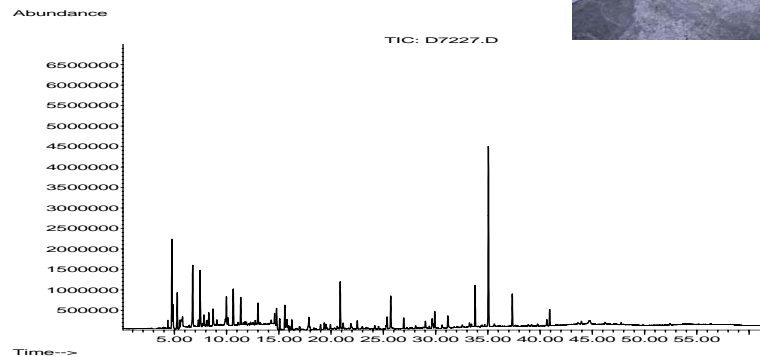
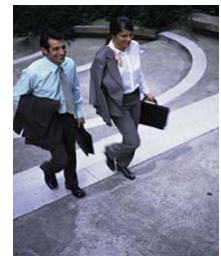
Over a few hundred compounds were detected such as :

- Volatile fatty acids - propionic acid, butyric acid
- Sulphur-containing compounds - hydrogen sulphide, methyl mercaptan, carbon disulphide, methyl disulphide and dimethyl disulphide
- Nitrogen-containing compounds - indole and skatol
- Phenols - phenol and cresols
- Aldehydes and Ketones - 2-octanone, 2-hexanone, acetophenone and hexanal, etc.
- Aromatics—toluene, xylenes, alkyl benzenes, indans and naphthalene, alkyl naphthalene and naphthenes

AN INDOOR AIR QUALITY COMPLAINT IN A RURAL OFFICE

Office workers complained of a transient odour inside a one-storey commercial building where no chemicals were used. Health effects included nose and throat irritation, headache and nausea. On the day of sampling, no odour was observed.

Analytical results from the samples taken in various locations of the office showed a large number of aliphatic hydrocarbons and aromatic hydrocarbons. Light alkanes, low molecular weight aldehydes and 1,3-butadiene were detected. In addition, methyl tert-butyl ether (MTBE) was found to be a major compound. MTBE is a flammable liquid with an unpleasant odour and is used in some regions as an additive for unleaded gasoline to achieve more efficient burning. The symptoms of exposure agreed with the health effects experienced by the workers. The profile suggests exhaust fumes from vehicles



temporarily stalling outside the building while the drivers entered the building were responsible for the transient odour.



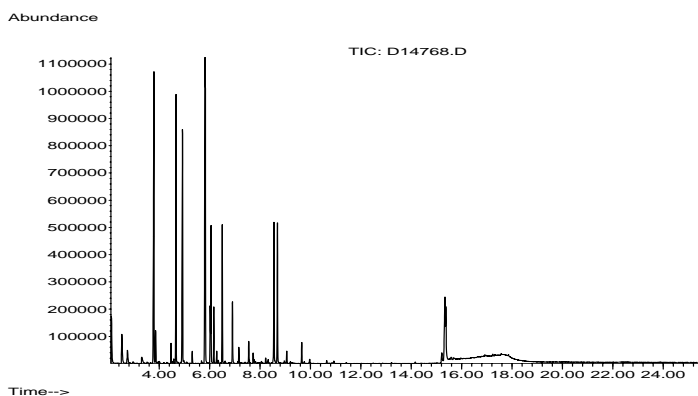
IDENTIFICATION OF AN UNKNOWN LIQUID FOUND IN AN APARTMENT BUILDING

A bottle containing an unknown liquid was found inside an apartment building. When opened, it was found to have a very pungent odour. Due to health concerns, the bottle was submitted for testing. A headspace sample was sampled onto a sorbent tube and the component was analyzed by thermal desorption/GC/MS.

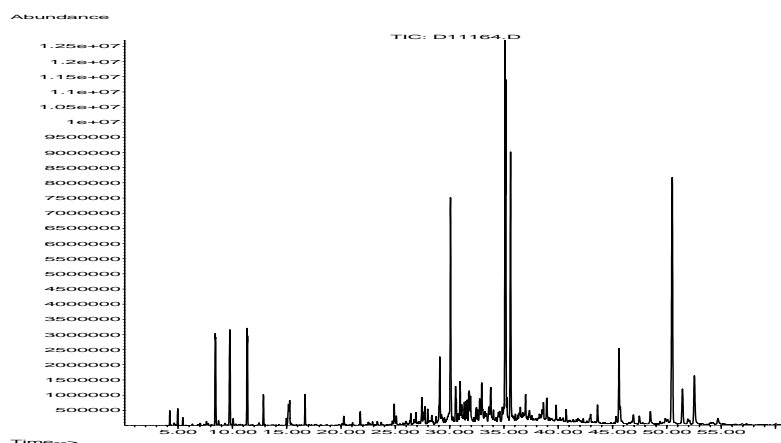
The analytical results showed a large amount of phenolic compounds, including alkyl and chloro-substituted phenols. The major organic compounds identified in this sample are presented below:

- Phenolic compounds – phenol, methyl phenols, dimethyl phenols, ethyl phenol, dimethyl dichlorophenols, dimethyl chlorophenols and dimethyl trichlorophenols
- Nitrogen-containing compounds – isoquinoline, benzonitrile, methyl pyridine, dimethyl pyridines, quinoline and benzonitrile
- Aromatic hydrocarbons and polynuclear aromatic hydrocarbons (PAHs) – naphthalene, indane, dibenzofuran, acenaphthene, fluorene, phenanthrene/anthracene

The content of the sample appeared to contain Creolin Disinfectant, which contains ingredients of carbolic oil and substituted phenols. Carbolic oil is also known as carbolic acid, middle oil or liquidified phenols. It is one of the fractions from coal tar distillation. The presence of large amounts of phenolic compounds and compounds such as pyridines will undoubtedly impart a strong and unpleasant odour when this material is used.



CHARACTERIZATION OF EMISSIONS FROM PLASTIC EXTRUSION PROCESS



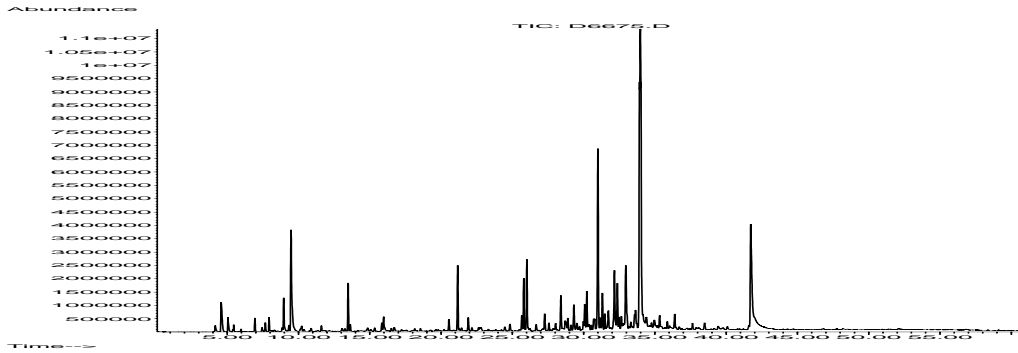
Odour concerns from a plastic extrusion process in a manufacturing facility resulted in the need to determine the content of emissions. Samples were collected during the extrusion process and submitted for analysis. A large number of volatile organic compounds were detected and the major ones are shown below:

- Acetate—vinyl acetate
- Alcohol—tert-butyl alcohol
- Volatile aromatics — alpha-methyl styrene, cumene and trimethyl benzenes
- Ketones—acetone, acetophenone, cuminone, p-acetyl-acetophenone and methyl ethyl ketone
- Organic acid—acetic acid
- Alcohols— isopropyl alcohol

In another plastic extrusion process, in addition to a large number of aliphatic hydrocarbons, a number of compounds were detected and their respective sources are presented below:

- 2,4-Di-tert-butylphenol—used as an intermediate for the preparation of anti-oxidants
- tert-Butylamine –used in the preparation of rubber accelerators and oil additive
- 1-Methyl-2-pyrrolidinone— used in industrial solvent for polymers

AN ODOUR COMPLAINT IN AN AUTOMOTIVE BRAKE PARTS MANUFACTURING FACILITY

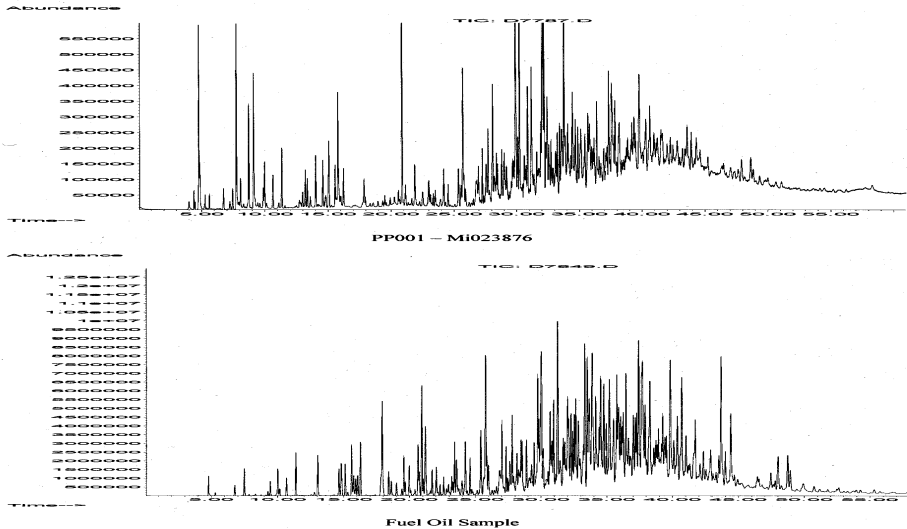


Subsequent to workers' complaints of odour during the curing of brake parts, thermal desorption tubes were used to investigate the emissions in the areas surrounding the curing oven. The analytical results showed the presence of the following major airborne organics:

- Hexamethylene tetramine
- Phenol
- 2,2,4,6,6-Pentamethyl heptane
- Methyl ethyl ketone
- tert-Butyl isothiocyanate
- Toluene
- Other hydrocarbons (both alkanes and alkenes)

The odour was mainly attributed to a combination of the above-mentioned compounds, especially phenol and alkenes.

INVESTIGATION OF POSSIBLE MIGRATION OF SPILLED FUEL OIL INTO A HOME



A large amount of fuel oil seeped into the basement of a home from a storage tank. The top chromatogram of the indoor air sample taken from the basement of the home shows typical low molecular weight VOCs (alcohols, ketones, hydrocarbons, etc. before 20 minutes) found in indoor environments. The large hump of VOCs after 25 minutes in the chromatogram are higher molecular weight aliphatic and aromatic hydrocarbons which illustrates a strong correlation with the fuel oil from the storage tank. Clear confirmation of chemical contamination of indoor air from fuel oil infiltration from contaminated soil can be achieved.

HOW TO CONTACT US

If you are experiencing air quality problems in your EH&S work, we invite you to try our services and experience the CASSEN Testing Laboratories difference. This brochure has demonstrated some of the power of the open characterization TD-GC-MS technique to solve different air quality problems. However, it is only a small sampling of the vast number of situations CTL has dealt with over the years. We encourage you to contact us to discuss a particular air quality situation in more detail. We can be reached at:

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