

Do You Know What is in Your Workplace Air?



TD/GC/MS Technique for Industrial Workplaces

- Very powerful tool in assessing overall exposure to the workers
- Typically 1000-fold enhancement in sensitivity
- Pre-screening the chemicals before starting the sampling plan
- Protect the health and safety of workers
- Reduce the unnecessary costs of the company by focusing on the problem in the very beginning
- Ability to deal with the lower threshold limit values
- Ability to detect low molecular weight VOCs which are not compatible with the charcoal tube method
- Allow detection of a wide range of VOCs in one analysis
- Positive confirmation of compound identities



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Investigation of Airborne Contaminants

Many solvents and volatile organic compounds (VOCs) have been used in various industrial workplaces. The effects of such compounds on human health can be severely detrimental leading to unpleasant symptoms, cancer and even death. The most common routes of exposure are by inhalation and skin adsorption. Thus, chemicals that have the potential to become airborne as gases, vapour, fumes or mists are evaluated by occupational hygienists for their risk of inhalation exposure. Traditional IH surveys have focused on sampling for chemicals used in the industrial workplaces; often missing hazardous compounds due to missing information on MSDS', wrong MSDS' in use, unannounced changes to product specifications, or thermal degradation or reaction byproducts from high temperature processes. To understand what airborne chemicals are present in a given workplace environment,



a broader picture of the workplace air is necessary before the design of any sampling strategies. With the combination of the MSDS information and the processes used in the plant, a more complete picture of chemical exposure can be obtained. This pre-screening approach will prove to be helpful to employers by reducing unnecessary costs by focusing on the problem at the very beginning. This new approach to industrial hygiene monitoring is also in line with the safe worker environment legal responsibilities of Bill C-45.

Traditional Industrial Hygiene Sampling for VOCs

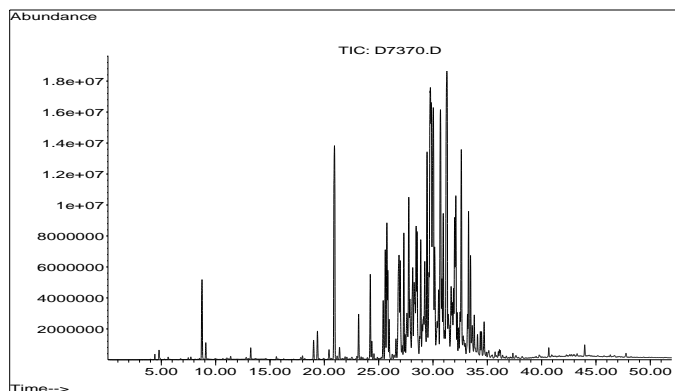
Traditional industrial hygiene monitoring for VOCs has been carried out by the collection of target organics onto charcoal or other suitable sorbent. Subsequent to this an extraction would be conducted using a solvent such as carbon disulphide. Analysis by gas chromatography with flame ionization detector (GC-FID) would then follow, completing the process. This approach to IH monitoring is effective when a few known chemicals are being targeted at relatively high concentrations. This approach however, has many limitations especially in complex workplace environments where many chemicals exist or the exact chemicals being used are unknown. It also tends to have sig-

nificant limitations during thermal degradation or reactions, when byproducts are formed from high temperature processes, for chemicals having low threshold limit values and for areas requiring short sampling times. When traditional IH sampling is applicable in a particular workplace, such sampling may require 5 or more different types of sampling media to be used at each location in addition to the number of samples to be taken. This is the case since traditional NIOSH, OSHA, ASTM, etc. methods for individual and multiple organic compounds are based on specific conditions such as sampling media, extraction solvent, instrument or detector used.

Thermal Desorption Gas Chromatography Mass Spectrometry for the Determination of Volatile Organic Compounds

In recent years, the technique of TD-GC-MS has found increasing applications in industrial hygiene monitoring especially in the screening and characterization of workplaces. The recent publication of standard methods by various government organizations (see below) for TD-GC-MS confirm this trend. For industrial workplaces, the TD-GC-MS technique is a very powerful tool used to assess the overall exposure of workers to VOCs, helping to protect their health and general job satisfaction. This approach enables workplace screening & characterization of chemicals before starting a more detailed IH sampling plan. Where other approaches may fail because of their narrow focus on specific chemicals, TD-GC-MS, because of its wide applicability to most VOCs, has the ability to provide solutions to problems when they develop. This technique can also reduce unnecessary costs to a company by identifying the problem upon

the first sample analysis. Finally, due to the high sensitivity of the TD-GC-MS it has the ability to deal with the move to lower threshold limit values and increasing worker sensitivity to chemicals.



Example of a mass chromatogram from an industrial workplace

Bill C-45 - Changing Workplace OH&S Responsibilities

"Bill C-45, an Act to amend the Criminal Code, is one of the most important legislative developments in recent Canadian legal history." a

The universality aspect of TD-GC-MS for detecting airborne organics makes it an ideal technique to meet a part of the new OH&S requirements of Bill C-45 that states:

- Reasonable steps are to be taken to prevent bodily harm to any person (worker or the public) arising from work; and

- Action is required by everyone with authority to direct, to show that they are exercising a proper standard of diligence

By better understanding the presence of volatile organic compounds VOCs in the workplace, necessary steps can be taken early to avoid over-exposure of workers to hazardous airborne organics.

In addition, better monitoring strategies can be implemented, thereby reducing unnecessary cost by focusing on the problem at the very beginning. Protecting the health and safety of workers is of paramount importance and it all starts with understanding the problems.

Note a: excerpt from "Workplace Health and Safety Crimes", Norm Keith, LexisNeis Canada 2004

Official Thermal Desorption 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