BOHS
British Occupational Hygiene Society

The Chartered Society for Worker Health Protection

Information for BOHS members on monitoring for organic isocyanates in air

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Purpose

The following information is made available to BOHS members in order that they make appropriately informed decisions when selecting methods for measuring airborne concentrations of isocyanates, and to ensure awareness of how to work under the Group Authority Licence (GAL).

Background

Di-isocyanates are used in the production of polyurethanes. These substances find widespread uses including the manufacture of paints, adhesives, and foams. However, isocyanates are potent respiratory sensitisers and those exposed may suffer from breathing disorders including occupational asthma.

To control health risks employers are legally required to reduce workers' exposures so far as is reasonably practicable under the COSHH Regulations(1), ensuring that Workplace Exposure Limits (WELs) are not normally exceeded. The WELs for di-isocyanates are 0.02 mg/m^3 (8-hour Time-Weighted Average) and 0.07 mg/m^3 (15-minute reference period)(2). Both WELs are expressed as "total -NCO".

The term "total -NCO" refers to the total reactive isocyanate groups (TRIG) within the sampled air. However, these isocyanate groups can be found in a variety of chemical types including aliphatic, aromatic, and cyclic substances, both as monomers and in longer chain oligomers and polymers. This represents a challenge for those developing sampling methods.

Only one validated method is currently available that allows measurement of TRIG in all chemical types. This methodology is that described in HSE Guidance Note MDHS25/4 "*Organic isocyanates in air*"(3). This is the only method that allows the data generated to be compared directly with the WELs. Whilst other methods are available, each suffers from disadvantages as they do NOT measure TRIG and care has to be taken with the evaluation of the data generated.

Considerations required when using MDHS25/4

Need to work under a Home Office licence

The sampling media used in MDHS25/4 contain 1-(2-methoxyphenyl)piperazine, known as1,2-MP. This is a controlled drug and those supplying or handling these sampling media can only legally do so under a Home Office licence (or a formal exemption). Members of BOHS Faculty of Occupational Hygiene at Associate level or higher can work under the BOHS Group Authority Licence (GAL), subject to certain conditions. This is discussed later.

Sampling media types need to be selected for their correct applications

The sampling media containing 1,2-MP are available in two forms:

- impregnated onto a glass-fibre filter (usual loading 2 mg)
- as a solution in toluene (0.05 mg/ml).

The filters are suitable for sampling for isocyanates present as vapours. As the filters can be loaded into sampling heads of the type used for dust sampling, the method is suitable for both personal and static sampling.

The solution is suitable for sampling for isocyanates in the form of aerosols. However, as the solution is held in an impinger, the method is not recommended for personal sampling. As the toluene may evaporate during the sampling period this may need topping up.

If the isocyanate may be present as both a vapour and an aerosol it will be necessary to use the impinger backed up with a filter. This sampling train would be suitable for static sampling only.

Appendix 2 of MDHS25/4 offers an alternative option where personal sampling is required for both vapours and aerosols. This involves the use of filters impregnated with twice the amount of 1,2-MP (4 mg), or using two “normally-loaded” filters in the same sampling head. Care has to be taken when interpreting the results using this option as under-reporting may occur with the long-term sampling of aerosols, where there is heavy loading, or where the aerosols include fast-reacting mixes such as aromatic isocyanates and some catalysed aliphatic isocyanates.

It must also be recognised that lapel-mounted sampling heads are not considered to be representative of the breathing zone when workers are wearing visors, as would usually be worn during paint-spraying for example.

Biological monitoring

Biological monitoring can be carried out for isocyanates providing information on body burden arising from all routes of exposure (inhalation, skin absorption and ingestion) over the shift.[4] This involves taking a urine sample immediately after the shift has been completed. The sample is analysed for the corresponding diamine. If other amines are present they may interfere leading to overestimation. A Biological Monitoring Guidance Value (BMGV) has been set at 1 µmol/mol creatinine[2] which, if complied with, indicates good occupational hygiene practice. HSE recommend that all paint-sprayers using isocyanate-containing paints have a urine test at least annually[5-7]. However, the test is useful in all applications where isocyanates are used.

Working under the GAL

The Standard Operating Procedure (SOP)

It is essential that the licence conditions imposed by the Home Office are complied with. These conditions have been embodied into the Standard Operating Procedure (SOP)[8]. To work under the GAL members must demonstrate appropriate knowledge of the GAL by passing the "GAL Assessment".

The GAL Assessment

The GAL Assessment is accessed online[9]. It consists of 14 multiple choice questions, and for each question only one of the answers is correct. All 14 questions must be correctly answered to pass. There is no limit to the number of attempts and the member can refer to the SOP during the assessment. It is anticipated that most will pass in less than 5 minutes. Laboratories supplying 1,2-MP are checking to ensure members requesting the sampling media have passed the GAL Assessment. If you have not passed they will not supply the sampling media.

GAL Webinar

Further information of the GAL, the SOP, and associated auditing process can be obtained by watching the Webinar[10].

REFERENCES

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3. Health and Safety Executive. *Organic isocyanates in air.* MDHS25/4. https://www.hse.gov.uk/pubns/mdhs/pdfs/mdhs25-4.pdf

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8. British Occupational Hygiene Society. Group Authority Licence Standard Operating Procedure (SOP) relating to the Prescribed Use of 1-(2-methoxyphenyl)piperazine in MSHS25. Version 4.0. May 2021. http://www.bohs.org/gal

9. The GAL Assessment http://www.bohs.org/gal

10. Using the Group Authority Licence (GAL), Midlands Region Webinar 15th October 2021. https://youtu.be/uoFjgYMp1Z8