

Biological Monitoring Guidance Values

Guidance sheet for:

2,2'-Dichloro-4,4' methylene dianiline (MbOCA) in urine

BMGV: 15µmol MbOCA/mol creatinine

Hazardous Substance

2,2'-Dichloro-4,4' methylene dianiline

CAS number: 101-14-4

Alternative names:

Methylene bis(2-chloroaniline) (MbOCA)

Workplace Exposure Limits:

8-hour TWA: 0.005mg/m³

Skin notation



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Biological Monitoring Guidance Value (BMGV)

Guidance value: 15µmol MbOCA/mol
creatinine

Conversion: 1µmol/mol = 2.361µg/g

Other Guidance Values

None.

Sample Collection

Urine samples should be collected at the end of shift into polystyrene universal containers (30mL).

Sample Transport to Laboratory

Send samples to the laboratory by first class post (or equivalent) to arrive within 48 hours of collection. If any delay is anticipated, store at -20°C. Packaging must comply with Post Office regulations.

Description of Suggested Method

Urine samples are spiked with ethylene dianiline (internal standard), heated at 100°C for 30 minutes to hydrolyse labile conjugates, and cooled. MbOCA is extracted from urine by liquid-liquid extraction with diethyl ether under alkaline conditions. Diethyl ether extracts are dried and derivatised with heptafluorobutyric anhydride in toluene at 60°C for 60 minutes. Derivatised samples are dried under nitrogen and resuspended in 100µL of toluene. Samples

are analysed by GC-MS with a BP-5 fused silica capillary column and the MS operating in negative ion chemical ionisation mode.

Analytical Evaluation

Detection limit:

5nmol/L (3 x background)

Calibration range:

Typically 0-160nmol/L

Precision:

- within day <7% RSD at 150µmol/L

- day to day <10% RSD at 150µmol/L

Sample stability:

2 days at ambient temperature, >3 months at 20°C

Analytical Interferences: None known

Other Information

Elimination half-time:

For MbOCA in urine, approximately 24 hours.

Confounding factors:

None known

Unexposed level:

None detected

Creatinine correction is advised

Toxicity of MbOCA:

MbOCA is a suspected human carcinogen¹.



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Alternative Methods

Ducos, P., Maire, C. and Gaudin, R., 1985. Assessment of occupational exposure to 4, 4'-methylene-bis-(2-chloroaniline) "MOCA" by a new sensitive method for biological monitoring. International archives of occupational and environmental health, 55(2), pp.159-167.

Okayama, A., Ichikawa, Y., Yoshida, M., Hara, I. and Morimoto, K., 1988. Determination of 4, 4'-methylenebis (2-chloroaniline) in urine by liquid chromatography with ion-paired solid-phase extraction and electrochemical detection. Clinical chemistry, 34(10), pp.2122-2125.

MbOCA may also be determined together with isocyanate metabolites in a single assay. In this case, internal standard solution (100µL, contains 1,6 hexamethylene-¹³C₂-diamine, d8-4,4-methylene dianiline and 1,7 heptane diamine) is added to each urine sample (2mL). The samples are then acidified with concentrated sulphuric acid (200µL), the tubes capped and then incubated at 100°C for 90 minutes. After cooling, sodium hydroxide (2mL, 10M) and diethyl ether (4mL) are added and the samples mixed for 20 minutes. They are then centrifuged, and 3mL of the ether layer is removed to a clean tube and the solvent evaporated under nitrogen. The residue is derivatised with heptafluorobutyric anhydride (20µL) in toluene (200µL) in closed tubes at 60°C for 1h. Samples are cooled; the derivatising agent is removed under

nitrogen and the residue reconstituted in toluene (100µL). This is then injected (2µL, splitless, 350°C) into a capillary column (30m x 0.3mm, ZB-5 1µm) at 150°C, increasing at 5°C/min to 200°C, then 25°C/min to 300°C. Detection is by mass spectrometry with negative ion chemical ionisation (methane).

Precision:

- within day <4.6% RSD at 150µmol/L
- day to day <5.3% RSD at 150µmol/L

Quality Assurance

Internal QC:

Must be established

External QA:

Available from Health and Safety Laboratory

Interpretation

Urinary MbOCA results reflect systematic exposure to MbOCA that may have entered the body by inhalation or more likely, through the skin. If biological monitoring results are greater than the guidance value, it does not necessarily mean that ill health will occur, but it does mean that exposure is not being adequately controlled. Under these circumstances employers will need to look at current work practices to see how they can be improved to reduce exposure.



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Links

EH40 List of Approved Workplace Exposure Limits

<http://www.hse.gov.uk/pubns/books/eh40.htm>

Biological Monitoring at HSL

<http://www.hsl.gov.uk/online-ordering/analytical-services-and-assays/biological-monitoring>

References

¹ Agency for Toxic Substances and Disease Registry (ATSDR), (1994). Public Health Statement for 4,4'-Methylenebis (2-chloroaniline) (MBOCA) [online] Available at: <http://www.atsdr.cdc.gov/PHS/PHS.asp?id=995&tid=209> [Accessed 11/05/2016].

Cocker, J., Nutley, B.P. and Wilson, H.K., 1996. Methylene bis (2-chloroaniline)(MbOCA): towards a biological monitoring guidance value. *Biomarkers*, 1(3), pp.185-189.

For further advice, please contact us:

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