Biological Monitoring Guidance Values

Guidance sheet for:

Xylene
Monitored by analysis of methyl hippuric acid in urine

BMGV: 650mmol methyl hippuric acid/mol creatinine

Hazardous Substance

Xylene
CAS number: 1330-20-7

Workplace Exposure Limits:

8-hour TWA: 50ppm, 220mg/m^3
15-minute STEL: 100ppm, 441mg/m^3
Skin notation

HSL: HSE's Health & Safety Laboratory

HEALTH & SAFETY LABORATORY

Biological Monitoring Guidance Values

Xylene in urine

Biological Monitoring Guidance Value (BMGV)

Guidance value: 650mmol methyl hippuric acid/mol creatinine
Conversion: 1mmol/mol = 1.71mg/g

Other Guidance Values

The ACGIH BEI is 1.5g/g creatinine (approx. 900mmol/mol creatinine). The DFG BAT is 2.0g/L (approx. 900mmol/mol creatinine).

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

Methyl hippuric acid in urine is determined by HPLC with UV detection[1,2].

Other Information

Elimination half-time:
For methyl hippuric acid in urine, approximately 1.5 and 20 hours (diphasic).

Confounding factors:
Xylene is metabolised by CYP 2E1, alcohol dehydrogenase and aldehyde dehydrogenase to methyl benzoic acid and then conjugated with glycine to form methyl hippuric acid. Any co-administration of substances which use these pathways will potentially interfere with xylene metabolism. The most likely interferences are alcohol and aspirin. Alcohol taken during xylene exposure will tend to increase blood and breath xylene levels. Aspirin at therapeutic doses can reduce the methyl hippuric acid in end-of-exposure urine samples by 50%. As a consequence, any co-administration of alcohol, aspirin or similar substances should be noted when collecting samples.

Unexposed level:
<1mmol/mol creatinine (<2mg/g)

Creatinine correction is advised

Biological Monitoring Guidance Values

Xylene in urine

Analytical Evaluation

Detection limit:
100µmol/L (20mg/L) (3 x background)

Calibration range:
Typically 0-5000µmol/L

Precision:
- within day <5% RSD
- day to day <10% RSD

Sample stability:
7 days at ambient temperature, >3 months at 20°C

Analytical Interferences: None known

Alternative Methods

Methyl hippuric acid may also be determined in urine by gas chromatography after derivatisation.

Buratti, M., Pellegrino, O., Valla, C., Fustinoni, S., Brambilla, G. and Colombi, A., 1999. Gas chromatography–electron-capture detection of urinary methylhippuric acid isomers as biomarkers of environmental exposure to xylene. Journal of Chromatography B: Biomedical Sciences and Applications, 723(1), pp.95-104.

Fustinoni, S., Giampiccolo, R., Pulvirenti, S., Buratti, M. and Colombi, A., 1999. Headspace solid-phase microextraction for the determination of benzene, toluene, ethylbenzene and xylenes in urine. Journal of Chromatography B: Biomedical Sciences and Applications, 723(1), pp.105-115.

Quality Assurance

Internal QC:
Must be established

External QA:
G-EQUAS (www.g-equas.de).
Email: G-EQUAS@ipasum.med.uni-erlangen.de.
Telephone: +49-9131-8522312.

Interpretation

Urinary methyl hippuric acid results reflect systematic exposure to xylene that may have entered the body by inhalation or 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.

Biological Monitoring Guidance Values

Xylene in urine

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] Miller, M.J. and Edwards, J.W., 1999. Possible preferential metabolism of xylene isomers following occupational exposure to mixed xylenes.International archives of occupational and environmental health, 72(2), pp.89-97.

[2] Krämer, A., Linnert Jr, M., Wrbitzky, R. and Angerer, J., 1999. Occupational chronic exposure to organic solvents XVII. Ambient and biological monitoring of workers exposed to xylenes. International archives of occupational and environmental health, 72(1), pp.52-55.

For further advice, please contact us:

Sample Registration, Health and Safety Laboratory, Harpur Hill, Buxton. SK17 9JN.

registration.sample@hsl.gsi.gov.uk

01298 218099