Guidance sheet for:

Chlorobenzene
Monitored by analysis of 4-chlorocatechol in urine

BMGV: 5mmol 4-chlorocatechol/mol creatinine

Hazardous Substance
Chlorobenzene
CAS number: 108-90-7

Workplace Exposure Limits:
8-hour TWA: 1ppm, 4.7mg/m³
15-minute STEL: 3ppm, 14mg/m³
Skin notation
Biological Monitoring
Guidance Value (BMGV)

Guidance value: 5mmol 4-chlorocatechol/mol creatinine
Conversion: 1mmol/mol = 1.278mg/g

Other Guidance Values

The ACGIH BEI is 100mg/g (approx. 78mmol/mol creatinine) and the DFG BAT is 150mg/g (approx. 137mmol/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

This HPLC-UV method was developed by Heinrich-Ramm to support the DFG biological monitoring programme. The metabolite 4-chlorocatechol is analysed as an indicator of exposure to chlorobenzene. The urine is spiked with 3-ethylephenol as an internal standard; then 5mL is acid hydrolysed (in 25% HCl at 90°C for 4 hours), and after cooling, the 4-chlorocatechol is extracted into diethyl ether. The extract is transferred to a clean vial and the ether removed under nitrogen. The residue is redissolved in HPLC mobile phase and injected into a C18 column at 34°C. Detection is at 205nm.

Analytical Evaluation

Detection limit:
0.1mg/L (approx. 0.08mmol 4-chlorocatechol/mol creatinine)

Calibration range:
Typically 0.5-50 mg/L

Precision:
- within day 2.3% RSD
- day to day 4.9% RSD

Sample stability:
>6 months at -20°C

Analytical Interferences: No peaks have been found in chromatograms interfering with 4-chlorocatechol levels greater than 0.5mg/L (approx. 0.4mmol 4-chlorocatechol/mol creatinine) from people not occupationally exposed to chlorobenzene.

http://www.hsl.gov.uk/online-ordering/analytical-services-and-assays/biological-monitoring
Biological Monitoring
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Other Information

Elimination half-time: For 4-chlorocatechol in urine, approximately 3-6 hours.

Confounding factors: None known

Unexposed level: <0.5mg/L (approx. 0.4mmol 4-chlorocatechol/mol creatinine)

Creatinine correction is advised

The major metabolites of chlorobenzene are 4-chlorocatechol (74%) and o-, m-, p-chlorophenols (3, 7, 12% respectively). The molecular weight of 4-chlorocatechol is 144.56.

Alternative Methods

A GC-MS method developed by Knecht & Wojtowitz (200) measures 4-chlorocatechol and chlorophenols². Urine (1mL) is saturated with sodium chloride (1g) and hydrolysed with hydrochloric acid (32% at 100°C for 1.5 hours). 2-bromophenol and 3, 4 dichlorophenol are used as internal standards. Metabolites are extracted into ether (3mL) and after removal of the solvent under nitrogen at room temperature, the residue is derivatised with N,O bis(trimethylsilyl) trifluoroacetamide (100µL) in pyridine (100µL) at 90°C for 1.5 hours. Separation and detection is by gas chromatography with electron impact selected ion detection.

Detection limit: 1mg/L (approx. 0.8mmol 4-chlorocatechol/mol creatinine)

Calibration range: Typically 5-50 mg/L

Precision: - within day 3.7% RSD at 50mg/L

Quality Assurance

Internal QC: Must be established

External QA: Available from Health and Safety Laboratory

Interpretation

Urinary 4-chlorocatechol results reflect systematic exposure to chlorobenzene 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.

http://www.hsl.gov.uk/online-ordering/analytical-services-and-assays/biological-monitoring
Biological Monitoring Guidance Values

Chlorobenzene 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


For further advice, please contact us:

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