IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

MEGA evaluations on exposure to camphor

1 Introduction

The measured data for workplace exposure evaluated in the following have been gathered and documented in accordance with the principles of the measurement system of the German social accident insurance institutions for exposure assessment (MGU[1], formerly BGMG). The quality of the MGU is upheld by a quality management system that in essence satisfies the requirements of DIN EN ISO 9001. The test laboratories are operated in accordance with DIN EN ISO 17025 “General requirements for the competence of testing and calibration laboratories”.

To measure exposure to camphor (CAS No. 76-22-2) at the workplace, a defined volume of air is sucked by a PAS pump through an activated carbon tube. For analysis, hazardous substance camphor is transferred with carbon disulfide. According to the method used in the MGU, camphor is analysed by gas chromatography, with detection by flame ionisation detector. The quantification limit is 1 mg/m³ for a sample air volume of 40 L. Sources:
Stoffe und Probenahmeverfahren im MGU (ref. no. 6009). In: IFA-Arbeitsmappe Messung von Gefahrstoffen. 47. Lfg. V/2011. Ed.: Deutsche Gesetzliche Unfallversicherung (DGUV), Berlin. Erich Schmidt, Berlin 2011 – loose-leaf edition.
Ketones II (Nr. 1301). In: NIOSH Manual of Analytical Methods, 4th ed., 8/15/94 (www.cdc.gov/niosh/docs/2003-154/pdfs/1301.pdf)

All the surveyed data in the MGU are brought together in the MEGA exposure database (measured data on exposure to hazardous substances at the workplace). The MEGA^{Pro} software developed by the IFA makes it possible to statistically analyse the data of the MEGA exposure database on the basis of various selection criteria and evaluation strategies.

[1] Gabriel, S.; Koppisch, D.; Range, D.: The MGU – a monitoring system for the collection and documentation of valid workplace exposure data. Gefahrstoffe – Reinhalt. Luft 70 (2010) No. 1/2, pp. 43-49 http://www.dguv.de/ifa, Webcode m200066

2 Data situation and evaluation strategy

2.1 Overview of the measured values collected in the MGU, data period 1983 to 2011

Camphor (CAS-no. 76-22-2)

Limit value according to the MAK list of the DFG: 13 mg/m³

General description	Number of measured values (%)
Total	84
Type of sampling: Stationary Personal	 36 (43%) 46 (55%)
Sampling time ≥ 2 h and exposure time ≥ 8 h (comparable to shift measurements) Sampling time < 2 h or exposure time < 8 h	45 (54%) 39 (46%)
Number of data < quantification limit	25 (30%)
Number of data > limit value	14 (17%)
Examples: Exposure conditions:	
Without mechanical ventilation With mechanical ventilation No details	34 (40%) 42 (50%) 8 (10%)
Without local exhaust ventilation With local exhaust ventilation No details	42 (50%) 33 (39%) 9 (11%)
Differentiation according to branch of industry: Chemical industry Glass and ceramics industry Electrical engineering, fine mechanics	 41 (49%) 14 (17%) 26 (31%)
Differentiation according to work area: Mixing Pressing, casting Filling, packaging Surface coating, gluing, cleaning Drying, smelting boiler, continuous kiln	 20 (24%) 11 (13%) 12 (14%) 22 (26%) 11 (13%)

2.2 Evaluation strategy

- Data period 1983 to 2011
- Measured data relating to exposure
- Workplace measurement (no interior values)
- Sampling is representative for exposure duration.
- If any single values fell below the measurement method's analytical quantification limit (a. q.), half of each value was adopted in the evaluation.
- Data sets comprising fewer than ten measured data were disregarded.
- The evaluation is performed according to industry groups (Chapter 4) and work area groups (Chapter 5).
- Owing to the small number of measured values available, no distinction is made between
  - stationary measurements and personal measurements,
  - measured values with or without local exhaust ventilation and
  - work areas per branch of industry.

3 Abbreviations and indices

The following abbreviations and indices are used in the evaluation tables:

Frequency < values	Number of measured values below the analytical quantification limit
a. q.	Analytical quantification limit
*	If any single values fell below the measurement method's analytical quantification limit (a. q.), half of each value was adopted in the evaluation.
+	The distribution value is below the largest analytical quantification limit (a. q.) in the data set. The quantification limit may deviate from the quantification limit quoted in the introduction, e.g. depending on sampling duration or flow rate.
!	The number of measured values below the analytical quantification limit (a. q.) is greater than the number of measured values represented by this cumulative frequency value. No concentration is therefore given for this cumulative frequency value.
$	With reference to the given limit value, the percentage of values below the limit value is given.

4 Statistic evaluations for industry groups

Camphor, data period 1983 to 2011

D.No. = Data set number/ Designation Branch of industry	Number of measured data	Number of firms	Frequency < number of values%	Largest quantification limit in mg/m³	Maximum value (mg/m³)	≤ limit value % $	Concentrations in mg/m³		
							50 per-centile *	90 per-centile *	95 per-centile *
D.No. 8 Chemical industry	41	11	8 19.5	0.2	= 20	92.7	0.375	8.9	14.75
D.No. 9 Glass and ceramics industry	14	8	14 100	1	< 1	100	! a.q.	! a.q.	! a.q.
D.No. 10 Electrical engineering, fine mechanics	26	5	0		= 38	57.7	7	29	34.8

The limit value was exceeded particularly during special applications in the manufacture of musical instruments.

5 Statistical evaluations for work area groups

Camphor, data period 1983 to 2011

D.No. = Data set number/ Designation Work area groups	Number of measured data	Number of firms	Frequency < number of values%	Largest quantification limit in mg/m³	Maximum value (mg/m³)	≤ limit value % $	Concentrations in mg/m³		
							50 per-centile *	90 per-centile *	95 per-centile *
D.No. 11 Mixing	20	5	4 20	0,2	8	100	+ 0,2	8	8
D.No. 12 Pressing, casting	11	7	4 36,4	1	2	100	+ 0,6	1,96	2
D.No. 13 Filling, packaging	12	6	1 8,3	0,1	20	83,3	0,4	13,4	16,4
D.No. 14 Surface coating, gluing, cleaning	22	5	8 36,4	1	38	59,1	6	31	35,6
D.No. 17 Drying, smelting boiler, continuous kiln	11	3	1 9,1	1	20	81,8	5	16,8	18,9

The limit value was exceeded particularly during bonding and the cleaning of the material by wiping with liquids.

6 Further statistical evaluations

No further statistical evaluation has been performed.

7 Overview lists

No lists have been compiled.

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