Cyclohexylamine / cyclohexanamine

MAK Value Documentation

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Abstract

The German Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area has re-evaluated the maximum concentration at the workplace (MAK value) for cyclohexylamine.
A 4-hour inhalation study with volunteers showed clear irritation at 10 ml/m³, whereas a time-weighted average concentration of 2 ml/m³ with peaks of up to 4 ml/m³ was without impact on sensory irritation parameters and neurobehavioral measurements. The MAK value of 2 ml/m³ and classification in Peak Limitation Category I has been retained. No irritation was observed up to 4 ml/m³; therefore, the excursion factor 2 has been retained as well. As cyclohexylamine is a strong base and 10 ml/m³ is clearly irritating, a momentary value of 5 ml/m³ is set.
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Keywords

cyclohexylamine; aminocyclohexane; aminohexahydrobenzene; cyclohexanamine; hexahydroaniline; peak limitation; occupational exposure; maximum workplace concentration; MAK value; toxicity; hazardous substance

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Cyclohexylamine

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MAK value (2003)	**2 ml/m³ (ppm) ≙ 8.2 mg/m³**
Peak limitation (2013)	**Category I, excursion factor 2**
Momentary value (2016)	**5 ml/m³**
Absorption through the skin	**–**
Sensitization	**–**
Carcinogenicity	**–**
Prenatal toxicity (2003)	**Pregnancy Risk Group C**
Germ cell mutagenicity	**–**
BAT value	**–**
1 ml/m³ (ppm) ≙ 4.12 mg/m³	**1 mg/m³ ≙ 0.243 ml/m³ (ppm)**

Documentation from 2003 (documentation "Cyclohexylamine" 2006) and a supplement from 2012 (supplement "Cyclohexylamin" 2012, available in German only) on the prenatal toxicity of cyclohexylamine are available. A volunteer study carried out with cyclohexamine has made a re-examination of the MAK value necessary.

Twelve male and 12 female volunteers aged between 20 and 36 (average age 25.3 and 25.5 years, respectively) were exposed 3 times for periods of 4 hours in an exposure chamber to different concentrations of cyclohexylamine. The interval between the exposures was at least 2 days for each volunteer. The constant concentration of 1 ml/m³ served as an odour control, the constant concentration of 10 ml/m³ as the maximum concentration. For the middle exposure condition, the concentration varied from 0 to 4 ml/m³ with four 15-minute peak concentrations during the 4-hour exposure. The average concentration under these conditions was 2 ml/m³. In each of the exposure patterns, chemosensory effects were subjectively classified every 30 minutes, visual neurobehavioural tasks were carried out three times for 30 minutes, and the blinking frequency was measured in the first and final 30 minutes of exposure. There was no concentration-dependent impairment in neurobehavioural performance parameters (reaction times, attention, motor inhibition, memory), so that no relationship could be established between exposure to cyclo-

hexylamine and the cognitive performance of the volunteers. At the concentration of 1 ml/m³, there was scarcely perceivable irritation of the eyes and nose (trigeminally mediated effect) and a scarcely perceivable odour, which was mildly unpleasant (olfactorily mediated effect). The exposure peaks during the exposure to 0 to 4 ml/m³ had only a slightly greater effect on chemosensory perception and on the symptoms. At the concentration of 10 ml/m³, the odour was pronounced and described as nauseous by the volunteers; irritation of the eyes and nose was moderate. The blinking frequency increased with the exposure duration under all three exposure conditions. Compared with at the concentration of 1 ml/m³, the blinking frequency was increased by 14% at 10 ml/m³. Statistically, this effect can only be regarded as a trend ($p < 0.1$). The following factors were discussed with regard to their influence on the results obtained, in particular the absence of distracting effects caused by the intense and unpleasant odour of cyclohexylamine: a bias in the selection of the participants, personality factors and the study design. Unequivocal and statistically significant effects were found only for the cyclohexylamine concentration of 10 ml/m³ (Juran et al. 2012).

Manifesto (MAK value/classification)

The critical effect of cyclohexylamine is irritation caused by its alkalinity.

MAK value. No long-term inhalation studies with animals are available. Since the documentation from 2003 (documentation "Cyclohexylamine" 2006), a volunteer study with 4-hour exposure to cyclohexylamine concentrations of 1 (odour control), 0 to 4, or 10 ml/m³ has been carried out (Juran et al. 2012). Clear substance-related findings such as irritation of the eyes and nose and an increased blinking frequency were found only at 10 ml/m³. This study supports the previous MAK value of 2 ml/m³, which was established after taking the effects of other aliphatic amines of similar alkalinity and with similar RD_{50} values into account. The MAK value of 2 ml cyclohexylamine/m³ has therefore been retained.

Peak limitation. Peak Limitation Category I for substances with local effects and the excursion factor of 2 have been retained for cyclohexylamine, as no irritation was found up to 4 ml/m³ in the volunteer study. A momentary value of 5 ml/m³ has been established for cyclohexylamine, as marked irritation of the eyes and nose of the volunteers occurred at the concentration of 10 ml/m³.

References

Juran SA, van Thriel C, Kleinbeck S, Schäper M, Falkenstein M, Iregren A, Johanson G (2012) Neurobehavioral performance in human volunteers during inhalation exposure to the unpleasant local irritant cyclohexylamine. NeuroToxicol 33: 1180–1187

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