The MAK Collection for Occupational Health and Safety

Addendum to Hexone (Methyl isobutyl ketone)

Assessment Values in Biological Material – Translation of the German version from 2014

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Keywords: 4-methylpentan-2-one; methyl isobutyl ketone; hexone; biological tolerance value; BAT value

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BAT 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 BAT value (biological tolerance value) for hexone (methyl isobutyl ketone, MIBK), considering methyl isobutyl ketone in urine to characterise the internal exposure. In a field study in 36 persons, which were exposed to a mixture of toluene, xylene and MIBK, a linear relationship between MIBK in air and MIBK in urine was obtained. For the present MAK-value of 20 ml MIBK/m^3 air a corresponding average concentration of 0.7 mg MIBK/l urine can be derived. In another field study 27 workers in the furniture industry were exposed to mixtures of solvents. The good linear correlation between the values determined in air and in urine permits an extrapolation to 20 ml/m^3, which yields a corresponding concentration of 0.60 mg MIBK/l urine.
Based on these studies, a BAT value of 0.7 mg MIBK/l urine was evaluated.
Sampling is performed at the end of exposure or the end of shift.

Keywords

4-methylpentan-2-one; methyl isobutyl ketone; MIBK; hexone; isobutyl methyl ketone; isopropylacetone; 4-methyl-2-pentanone; occupational exposure; biological tolerance value; BAT value; BLW; toxicity

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BAT (2014)	**0.7 mg methyl isobutyl ketone/l urine** Sampling time: end of exposure or end of shift
MAK value (1996)	**20 ml/m³ ≙ 82 mg/m³**
Absorption through the skin (1996)	H
Carcinogenicity	–

In 1991 the BAT value (biological tolerance value) for methyl isobutyl ketone (MIBK) was set at 3.5 mg/l urine (sampling time: end of exposure or end of shift) and confirmed in 1992. The derivation was based on the data available for the relationship between external and internal exposure, taking the MAK value of 100 ml/m³ as a reference for the setting of the BAT value. The last re-evaluation of the MAK value for MIBK was in 1996, in which the value of 100 ml/m³ from 1976 was lowered to 20 ml/m³ based on new data available (Greim 1996, translated).

1 Re-evaluation

The BAT value for MIBK was set on the basis of a field study in 36 persons, which, while adding thinner to paints, were exposed to a mixture of toluene, xylene and MIBK (Ogata et al. 1990, 1995). In this study a linear relationship between $MIBK_{air}$ and $MIBK_{urine}$ was obtained (see Figure 1):

$$\mathbf{C_{urine}\ [\mu g/l] = C_{air}\ [ml/m^3] \cdot 35.2}$$

With a regression coefficient of 0.9 the relationship was considered to be stable enough to justify an extrapolation beyond the range of measured values. The concentration of 3.5 mg MIBK/l urine correlating with the concentration of 100 ml MIBK/m³ was derived from the intersection point of the extended x-axis with the extended regression line, thus based on averages of the value pairs. For a concentration of 20 ml MIBK/m³ air an average concentration of 0.7 mg MIBK/l urine can be derived.

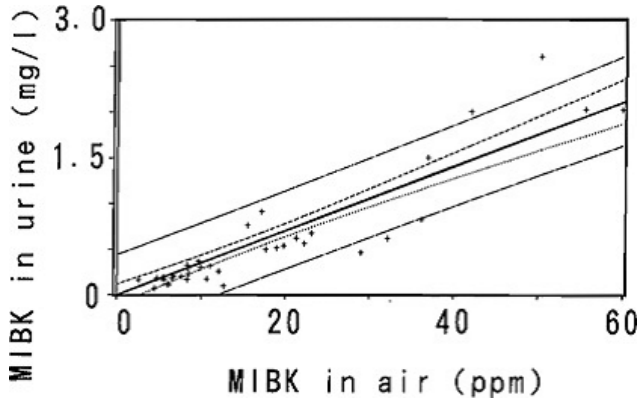

Figure 1 Correlation between the concentration of MIBK in the workplace air and excretion of the substance in the urine of 36 workers occupationally exposed to a solvent mixture of toluene, xylenes and methyl isobutyl ketone (Ogata et al. 1995)

This study also reports on the results of a controlled exposure of two volunteers to MIBK for 6 hours. The relationship obtained was as follows:

$$\mathbf{C_{urine}\ [\mu g/l] = C_{air}\ [ml/m^3] \cdot 47.3}$$

For a concentration at the level of the MAK value of 20 ml/m^3, a concentration of 0.95 mg MIBK/l urine is calculated from this equation.

However, this study is not used for the evaluation because it is only based on two persons.

Since the last evaluation another field study has been published in which 27 workers in the furniture industry were exposed to mixtures of solvents (Kawai et al. 2003). The average 8-hour MIBK concentration in the air was only 1.8 ml/m^3; the highest measured value was 15.1 ml/m^3 (see Figure 2).

The good linear correlation between the values determined in air and in urine again permits an extrapolation to 20 ml/m^3, which, according to the formula given by the authors, i.e.

$$\mathbf{C_{urine}\ [\mu g/l] = 12.2 + C_{air}\ [ml/m^3] \cdot 29.2}$$

yields a concentration of 0.60 mg MIBK/l urine.

The results of the two field studies agree well enough to derive a BAT value of

0.7 mg methyl isobutyl ketone/l urine.

Sampling should be carried out at the end of exposure or end of shift.

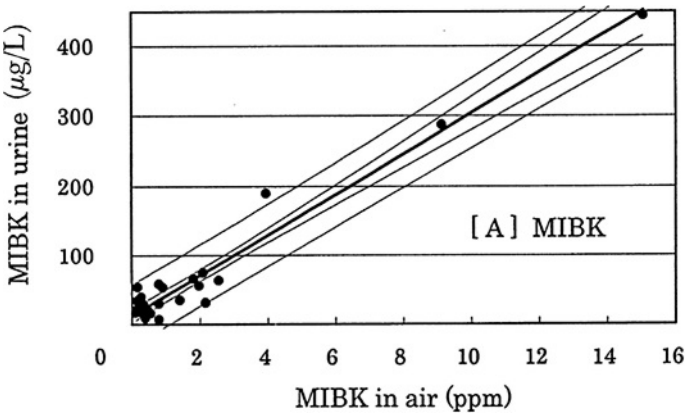

Figure 2 Correlation between the concentration of MIBK in the workplace air and excretion of the substance in the urine of workers occupationally exposed to MIBK and methyl ethyl ketone (Kawai et al. 2003)

2 References

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