
Dibutyl hydrogen phosphate

(CAS No: 107-66-4)

Health-based Reassessment of Administrative Occupational Exposure Limits

Committee on Updating of Occupational Exposure Limits,
a committee of the Health Council of the Netherlands

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1 Introduction

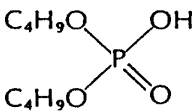
The present document contains the assessment of the health hazard of dibutyl hydrogen phosphate by the Committee on Updating of Occupational Exposure Limits, a committee of the Health Council of the Netherlands. The first draft of this document was prepared by MA Maclaine Pont, M.Sc. (Wageningen University and Research Centre, Wageningen, the Netherlands).

In February 1998, literature was searched in the databases Medline, Toxline, and Chemical Abstracts, starting from 1966, 1981, and 1937, respectively, and using the following key words: dibutyl phosphate; 107-66-4; and phosphoric acid, dibutylester.

In February 2001, the President of the Health Council released a draft of the document for public review. No comments were received.

An additional search in Toxline and Medline in January 2004 did not result in information changing the committee's conclusions.

2 Identity

name	:	dibutyl hydrogen phosphate
synonyms	:	dibutyl phosphate; phosphoric acid, dibutyl ester; dibutyl acid phosphate; di-n-butyl phosphate
molecular formula	:	$C_8H_{19}O_4P$
structural formula	:	
CAS number	:	107-66-4

3 Physical and chemical properties

molecular weight	:	210.21
boiling point	:	decomposes at >100°C
melting point	:	ca. -13°C
flash point	:	188°C
vapour pressure	:	at 20°C: < 0.1 kPa
solubility in water	:	slightly soluble (at 20°C: 1,8 g/100 mL)
log P _{octanol/water}	:	0.6-1.4 (estimated); 2.29 (estimated)
conversion factors	:	at 20°C, 101.3 kPa: 1 ppm = 8.8 mg/m ³ 1 mg/m ³ = 0.11 ppm

Data from ACG91, GCS95, <http://esc.syrres.com>.

Dibutyl hydrogen phosphate is a pale amber liquid. It is a moderately strong base (ACG91).

4 Uses

Dibutyl hydrogen phosphate is used in industrial operations as an organic catalyst and an antifoaming agent (ACG91).

5 Biotransformation and kinetics

When single doses of dibutyl hydrogen phosphate of 250 mg/kg bw were intraperitoneally administered to male rats, the compound was mainly excreted unchanged in the urine (47.6%). Three metabolites were found in the urine, in concentrations of 0.1% or less of the administered dose. The rest of the dose was not accounted for (Suz84).

Dibutyl hydrogen phosphate is the major metabolite of tributyl phosphate. After single intraperitoneal injections of doses of tributyl phosphate of 250 mg/kg bw into rats, 16, 1.6, and 0.3% of the dose were excreted via the urine as dibutyl hydrogen phosphate in respectively the first, second, and third day. After a single intraperitoneal injection of 50 mg/kg bw, these numbers were 4.6, 0.5, and 0.08%, respectively (Suz84).

6 Effects and mechanism of action

Human data

Workers exposed to unspecified concentrations of dibutyl hydrogen phosphate vapour complained of respiratory irritation and headache. There are no further data (ACG91, GCS95).

Animal data

Eight-hour semi-occlusive application of 500 µL of dibutyl hydrogen phosphate to the ears of rabbits was reported to be highly irritating. Instillation of 100 µL into the eyes of rabbits caused severe irritation and corrosion of the cornea (GCS95).

In rats, an oral LD₅₀ of 3200 mg/kg was found (GCS95).

Dibutyl hydrogen phosphate was negative when tested in *S. typhimurium* strains TA98, TA100, TA1535, and TA1537, with and without metabolic activation (GCS95).

The committee did not find other data on the toxic effects of dibutyl hydrogen phosphate.

7 Existing guidelines

The current administrative occupational exposure limit (MAC) for dibutyl hydrogen phosphate in the Netherlands is 5 mg/m³, 8-hour TWA.

Existing occupational exposure limits for dibutyl hydrogen phosphate in some European countries and in the USA are summarised in the annex.

8 Assessment of health hazard

Dibutyl hydrogen phosphate was severely irritating to the skin and corrosive to the eyes of rabbits. The compound was negative in an *in vitro* mutation assay in several *S. typhimurium* strains.

The committee did not find relevant human and other experimental animal data on the toxic effects of dibutyl hydrogen phosphate.

The committee considers the toxicological database on dibutyl hydrogen phosphate too poor to justify recommendation of a health-based occupational exposure limit.

The committee concludes that there is insufficient information to comment on the level of the present MAC value.

References

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- ACG03 American Conference of Governmental Industrial Hygienists (ACGIH). Guide to occupational exposure values - 2003. Cincinnati OH, USA: ACGIH®, 2003: 41.
- ACG04 American Conference of Governmental Industrial Hygienists (ACGIH). 2004 TLVs® and BEIs® based on the documentation of the Threshold Limit Values for chemical substances and physical agents & Biological Exposure Indices. Cincinnati OH, USA: ACGIH®, 2004: 23.
- Arb02 Arbejdstilsynet. Grænseværdier for stoffer og materialer. Copenhagen, Denmark: Arbejdstilsynet, 2002: 22 (At-vejledning C.0.1).
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- GCS95 German Chemical Society - Advisory Committee on Existing Chemicals of Environmental Relevance (BUA). BUA Reports 105-108. Melamine, BUA Report 105 (June 1992); diisopropanolamine, BUA Report 106 (October 1992); 1,6-hexanediol, BUA Report 107 (October 1992); tri/dibutyl phosphate, BUA Report 108 (December 1992). Stuttgart, FRG: Hirzel Wissenschaftliche Verlagsgesellschaft, 1995.
- HSE02 Health and Safety Executive (HSE). EH40/2002. Occupational Exposure Limits 2002. Sudbury (Suffolk), England: HSE Books, 2002: 16.
- Suz84 Suzuki T, Sasaki K, Takeda M, et al. Metabolism of tributyl phosphate in male rats. J Agric Food Chem 1984; 32: 603-10.
- Swe00 Swedish National Board of Occupational Safety and Health. Occupational exposure limit values and measures against air contaminants. Solna, Sweden: National Board of Occupational Safety and Health, 2000; Ordinance AFS 2000:3.
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- SZW04 Ministerie van Sociale Zaken en Werkgelegenheid (SZW). Nationale MAC-lijst 2004. The Hague, the Netherlands: Sdu Uitgevers, 2004: 23.
- TRG03 TRGS 900. Grenzwerte in der Luft am Arbeitsplatz; Technische Regeln für Gefahrstoffe. BArBl 2003; (9).

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Annex

Occupational exposure limits for dibutyl hydrogen phosphate in various countries.

country - organisation	occupational exposure limit		time-weighted average	type of exposure limit	note ^a	reference ^b
	ppm	mg/m ³				
the Netherlands - Ministry of Social Affairs and Employment	1	5	8 h	administrative		SZW04
Germany - AGS	-	5	8 h			TRG03
- DFG MAK-Kommission	-	-				DFG03
Great Britain - HSE	1 2	8.7 17	8 h 15 min	OES		HSE02
Sweden	-	-				Swe00
Denmark	1	8.6	8 h			Arb02
USA - ACGIH	1 2	- -	8 h 15 min	TLV STEL		ACG04
- OSHA	1	5	8 h	PEL		ACG03
- NIOSH	1 2	5 10	10 h 15 min	REL		ACG03
European Union - SCOEL	-	-				EC04

^a S = skin notation; which means that skin absorption may contribute considerably to the body burden; sens = substance can cause sensitisation.

^b Reference to the most recent official publication of occupational exposure limits.