

4. CHEMICAL AND PHYSICAL INFORMATION

4.1 CHEMICAL IDENTITY

Information regarding the chemical identity of malathion is located in Table 4-1.

Malathion is manufactured in the United States as a technical-grade concentrate that is >90% pure malathion and contains approximately 5% of impurities consisting largely of reaction byproducts and degradation products. As many as 14 impurities have been identified in technical-grade malathion. The identities of the impurities and their percent (w/w) in technical grade malathion were found to be as follows: S-1,2-ethyl-*O,S*-dimethyl phosphorodithioate (isomalathion; 0.2%), S-1,2-bis(ethoxycarbonyl)-ethyl-*O,O*-dimethyl phosphorothioate (malaxon; 0.1%), diethylfumarate (DEF; 0.9%), *O,S,S*-trimethyl phosphorodithioate (0.003–1.2%), *O,O,S*-trimethyl phosphorothioate (0.04%), *O,O,S*-trimethyl phosphorodithioate (1.2%), *O,O,O*-trimethyl phosphorothioate (0.45%), diethylhydroxysuccinate (0.05%), ethyl nitrite (0.03%), diethyl mercaptosuccinate (0.15%), diethyl methylthiosuccinate (1.0%), *O,O*-dimethylphosphorothioate (0.05%), diethyl ethylthiosuccinate (0.1%), and sulfuric acid (0.05%). Malathion is formulated as an emulsifiable concentrate (EC), a dust (D), a wettable powder (WP), a ready-to-use (RTU) liquid, and a pressurized liquid. The quantity of active ingredient (ai) in EC and RTU formulations is variable and can contain up to 82 and 95%, respectively (Brown et al. 1993b; EPA 2001a).

4.2 PHYSICAL AND CHEMICAL PROPERTIES

Information regarding the physical and chemical properties of malathion is located in Table 4-2.

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Table 4-1. Chemical Identity of Malathion

Characteristic	Information	Reference
CAS Nomenclature	Diethyl[(dimethoxyphosphinothioyl)thio]butanedioate	CAS 2001
Common name	Malathion	Howard and Neal 1992
Synonym(s)	1,2-Di(ethoxycarbonyl)ethyl O,O-dimethyl phosphorodithioate	Howard and Neal 1992
Registered trade name(s)	Cekumal Fyfanon [®] Malixol [®] Maltox [®]	Farm Chemicals Handbook 2000 Howard and Neal 1992 Farm Chemicals Handbook 2000 Howard and Neal 1992
Chemical formula	C ₁₀ H ₁₉ O ₆ PS ₂	Howard and Neal 1992
Chemical structure	<p>Butanedioic acid, [(dimethoxyphosphinothioyl) thio]-, diethyl ester (malathion)</p>	
Identification numbers:		
CAS registry	000121-75-5	Howard and Neal 1992
NIOSH RTECS	WM8400000	HSDB 2001
EPA hazardous waste OHM/TADS		
DOT/UN/NA/IMCO	NA 2783; Malathion	HSDB 2001
shipping	665	HSDB 2001
HSDB		
NCI		

CAS = Chemical Abstracts Services; DOT/UN/NA/IMCO = Department of Transportation/United Nations/North America/International Maritime Dangerous Goods Code; EPA = Environmental Protection Agency; HSDB = Hazardous Substances Data Bank; NCI = National Cancer Institute; NIOSH = National Institute for Occupational Safety and Health; OHM/TADS = Oil Hazardous Materials/Technical Assistance Data System; RTECS = Registry of Toxic Effects of Chemical Substance

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Table 4-2. Physical and Chemical Properties of Malathion

Property	Information	Reference
Molecular weight	330.36	Howard and Neal 1992
Color	Colorless liquid (pure form) Deep brown to yellow	Matsumura 1985 Budavari 1996; NIOSH 1997
Physical state	Liquid	Matsumura 1985
Melting point	2.9 °C	Budavari 1996
Boiling point	156–157 °C	Budavari 1996
Boiling point pressure	0.7 torr	
Density:		
at 25 °C	1.23 g/cm ³	Budavari 1996
Odor	Garlic-like Mercaptan	NIOSH 1997 Farm Chemicals Handbook 1999
Odor threshold:		
Water 60 °C	1.0 mg/L	Fazzalari 1978
Air	13.5 mg/m ³ (low) and 13.5 mg/m ³ (high)	Ruth 1986
Solubility:		
Water at 20 °C	145 mg/L	
Organic solvent(s)	Miscible with alcohols, esters, ketones, ethers, aromatics, and vegetable oil; limited solubility in paraffin hydrocarbons	Tomlin 1997 Budavari 1996
Partition coefficients:		
Log K _{ow}	2.36	Hansch et al. 1995
Log K _{ow}	2.89	Chiou et al. 1977; Freed et al. 1978
Log K _{oc}	3.25	Buyuksonmez 1999
Vapor pressure		
at 25 °C	5.03x10 ⁻⁶ torr	Watanabe 1993
at 30 °C	3.38x10 ⁻⁶ torr	SRC 2000
at 25 °C	7.9x10 ⁻⁶ torr	Kim et al. 1984
Henry's law constant (25 °C)	4.9x10 ⁻⁹ atm m ³ /mol	Fendinger et al. 1990
Autoignition temperature	No data	
Flashpoint	163 °C ^a	Farm Chemicals Handbook 1989
Flammability limits	No data	
Conversion factors ^b	No data	
Explosive limits	Containers of malathion may explode in a fire	U.S. Coast Guard 1984–1985

^aPensky-Martens closed cup test^bThe conversion factor for ppm to mg/m³ is: ppm = (mg/m³) (24.45 L/mole)/(g/mole).

