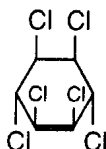


## NOME COMUNE: LINDANE

### FORMULA DI STRUTTURA:



**Classe chimica:** clororganici  
**N.ro CAS** [58-89-9]

**USO:** insetticida impiegato esclusivamente per la concia delle sementi e per la disinfestazione di terreni destinati alla barbabietola da zucchero

**DOSE MASSIMA DI IMPIEGO (g p.a./ha):** 1050 (Muccinelli, 1993)

### PROPRIETA' FISICO-CHIMICHE

**Peso molecolare:** 290,85

#### Solubilità in acqua (mg/L) (25°C):

1,5E<sup>-01</sup> (Biggar & Riggs, 1974; Kenaga & Goring, 1980; Martin & Worthing, 1977; Kenaga 1980a; Bruggeman *et al.*, 1981; Zaroogian *et al.*, 1985; Adams, 1987; Suntio *et al.*, 1988);  
5,0E<sup>-01</sup>, 6,60 (Robeck *et al.*, 1965; Biggar & Riggs, 1974);  
2,0 (Hollifield, 1979; Howard, 1991);  
2,15 (15°C, Biggar & Riggs 1974, Callahan *et al.*, 1979; Kucklick *et al.*, 1991);  
5,70 (Atkins & Eggleton, 1971);  
5,75-7,40 (28°C, Kurihara *et al.*, 1973; Callahan *et al.*, 1979);  
5,79 (Mailhot & Peters, 1988; Chessells *et al.*, 1992);  
6,11 (20°C, Deutsche Forschungsgemeinschaft, 1983; Ballschmiter & Wittlinger 1991; Fischer *et al.*, 1991);  
6,50 (20°C, Suntio *et al.*, 1988; Schreitmliller & Ballschmiter, 1995);  
6,61, 6,24 (28°C, Kurihara *et al.*, 1973);  
6,98 (Caron *et al.*, 1985);  
7,0 (20-25°C, Wauchope *et al.*, 1992; Lohninger, 1994; Hornsby *et al.*, 1996; 20°C, Calamari *et al.*, 1991; Thomas, 1982; Nash, 1988);  
7,08 (Isnard & Lambert, 1988);  
7,3 (Richardson & Miller, 1960; Biggar & Riggs, 1974; Freed, 1976; 20°C, Lyman *et al.*, 1990; Hemond & Fechner, 1994; Agrochemicals Handbook, 1987; Tomlin, 1994; Milne, 1995; Gunther *et al.*, 1968, Mackay & Wolkoff, 1973; Metcalf *et al.*, 1973; Mackay & Leinonen, 1975; Geyer *et al.*, 1980; Suntio *et al.*, 1988; Yalkowsky, 1987);  
7,5 (Freed 1976; Jury *et al.*, 1983; Spencer *et al.*, 1988; Taylor & Glotfelty, 1988; Mackay & Stiver, 1991);  
7,52 (Montgomery, 1993; Mackay *et al.*, 1986; Freed, 1976; Callahan *et al.*, 1979);  
7,8 (Weil *et al.*, 1974; Callahan *et al.*, 1979; Geyer *et al.*, 1980,82; Chiou *et al.*,

	1986; Suntio <i>et al.</i> , 1988);
7,87	(24°C, Chiou <i>et al.</i> , 1986);
7,88	(20-25°C, Kanazawa, 1981; Platford, 1981);
7,94	(Kanazawa, 1989);
9,0E <sup>-01</sup>	(10°C, McLachlan <i>et al.</i> , 1990);
9,12	(OECD, 1981; Davies & Dobbs, 1984);
10	(Burkhard & Guth, 1981; Ulmann, 1972; Malalyandi <i>et al.</i> , 1982; Boehncke <i>et al.</i> , 1990; Pinsuwan <i>et al.</i> , 1995; Gerstl & Helling, 1987; Neary <i>et al.</i> , 1993; 20-25°C, Platford, 1981; 20°C, Slade 1945; Gunther <i>et al.</i> , 1968; Suntio <i>et al.</i> , 1988; Spencer, 1973, Fuhrenmann & Lichtenstein, 1980; Sharom <i>et al.</i> , 1980);
10,3	(Malaiyandi <i>et al.</i> , 1982);
12	(26,5°C, Bhavnagary & Jayaram, 1974; Callahan <i>et al.</i> , 1979);

### Tensione di vapore (Pa) (25°C):

5,45E <sup>-04</sup>	(15°C, Balson, 1947, Kucklick <i>et al.</i> , 1991);
7,43E <sup>-04</sup>	(Howard, 1991);
1,22E <sup>-03</sup>	(20°C, Lyman <i>et al.</i> , 1990; Hemond & Fechner, 1994);
1,24E <sup>-03</sup>	(20°C, Balson, 1947, Freed 1976; Spencer 1982; Kucklick <i>et al.</i> , 1991; Boehncke <i>et al.</i> , 1996);
1,25E <sup>-03</sup>	(20°C, Spencer, 1973; Fuhrenmann & Lichtenstein, 1980; 20°C, Montgomery, 1993; 20° C, Martin, 1972, Melnikov, 1971, Quелlette & King, 1977, Callahan <i>et al.</i> , 1979; Hartley & Graham-Bryce, 1980; Suntio <i>et al.</i> , 1988; Mackay & Wolkoff, 1973, Mackay & Leinonen, 1975);
1,90E <sup>-03</sup> , 3,2E <sup>-02</sup>	(Fischer <i>et al.</i> , 1991);
2,60E <sup>-03</sup>	(20° C, Dobbs & Grant, 1980; Dobbs & Cull, 1982);
2,80E <sup>-03</sup>	(20°C, Zimmerli & Marek, 1974);
3,00E <sup>-03</sup>	(20°C, Suntio <i>et al.</i> , 1988; Schreitmüller & Ballschmiter, 1995);
3,68E <sup>-03</sup>	(Kim, 1985);
3,83E <sup>-03</sup>	(20° C, Boehncke <i>et al.</i> , 1996);
4,00E <sup>-03</sup>	(20°C, Calamari <i>et al.</i> , 1991);
4,10E <sup>-03</sup>	(Mackay <i>et al.</i> , 1986);
4,13E <sup>-03</sup>	(20°C, Atkins & Eggleton, 1971; Freed, 1976; Suntio <i>et al.</i> , 1988; Boehncke <i>et al.</i> , 1996);
4,26E <sup>-03</sup>	(Burkhard & Guth, 1981);
4,35E <sup>-03</sup>	(20°C, Spencer & Cliath, 1970; Freed, 1976; Dobbs & Cull, 1982; Suntio <i>et al.</i> , 1988; Boehncke <i>et al.</i> , 1996);
4,40E <sup>-03</sup>	(20-25° C, Wauchope <i>et al.</i> , 1992; Hornsby <i>et al.</i> , 1996);
5,60E <sup>-03</sup>	(20° C, Agrochemicals Handbook, 1987; Worthing, 1983; Tomlin, 1994);
8,50E <sup>-03</sup>	(Mackay & Stiver, 1991);
8,60E <sup>-03</sup>	(Jury <i>et al.</i> , 1983; Taylor & Glotfelty, 1988);
8,63E <sup>-03</sup>	(Jury <i>et al.</i> , 1987; Spencer <i>et al.</i> , 1988);
9,40E <sup>-03</sup>	(20° C, Wania <i>et al.</i> , 1994);
1,71 E <sup>-02</sup>	(30° C, Spencer & Cliath, 1970);
1,9 E <sup>-02</sup>	(20°C, Deutsche Forschungsgemeinschaft, 1983; Ballschmiter & Wittlinger, 1991; Fischer <i>et al.</i> , 1991);
2,133 E <sup>-02</sup>	(20° C, Demozay & Marechal, 1972; Callahan <i>et al.</i> , 1979);
3,59 E <sup>-02</sup>	(Caron <i>et al.</i> , 1985);
3,98E <sup>-02</sup>	(20°C Hinckley <i>et al.</i> , 1990; Cotham & Bildeman, 1992);
4,192 E <sup>-02</sup>	(30° C, Wania <i>et al.</i> , 1994);

**Coefficiente di ripartizione n-ottanolo/acqua (log K<sub>ow</sub>):**

2,81	(Rao & Davidson, 1980);
3,20, 3,29	(Geyer <i>et al.</i> , 1982);
3,20-3,89	(Montgomery, 1993);
3,24	(Carlberg <i>et al.</i> , 1986);
3,25	(Platford, 1982);
3,30, 3,20	(Geyer <i>et al.</i> , 1984; Sicbaldi & Finizio, 1993);
3,51	(Noegrohati & Hammers, 1992);
3,517	(Yalkowsky & Dannenfelser, 1994; Pinsuwan <i>et al.</i> , 1995);
3,52, 3,75, 3,26	(Finizio <i>et al.</i> , 1997);
3,53	(Hermens & Leeuwangh, 1982; Hermens <i>et al.</i> , 1985; Verhaar <i>et al.</i> , 1992);
3,61	(Hansch & Leo 1985; Howard, 1991; Muller <i>et al.</i> , 1994; Chessells <i>et al.</i> , 1992);
3,65	(Sugiura <i>et al.</i> , 1979);
3,66	(Travis & Arms, 1988; Kanazawa, 1981; Davies & Dobbs, 1984; Sicbaldi & Finizio, 1993; Finizio <i>et al.</i> , 1997);
3,688	(De Bruijn <i>et al.</i> , 1989; Parkerton <i>et al.</i> , 1993; Sicbaldi & Finizio, 1993; Finizio <i>et al.</i> , 1997);
3,69	(Geyer <i>et al.</i> , 1990);
3,70	(Kurihara <i>et al.</i> , 1973; McKim <i>et al.</i> , 1985, Thomann, 1989; Boehncke <i>et al.</i> , 1990; McLachlan <i>et al.</i> , 1990);
3,72	(Hansch <i>et al.</i> , 1995; Devillers <i>et al.</i> , 1996; Kurihara <i>et al.</i> , 1973, Callahan <i>et al.</i> , 1979; McDuffie, 1981; Mackay <i>et al.</i> , 1986; Gerstl & Helling, 1987; Suntio <i>et al.</i> , 1988; Ryan <i>et al.</i> , 1988; Sicbaldi & Finizio, 1993; Finizio <i>et al.</i> , 1997);
3,72, 3,62	(McDuffie, 1981);
3,752	(Pinsuwan <i>et al.</i> , 1995);
3,80	(Suntio <i>et al.</i> , 1988, Bacci <i>et al.</i> , 1990; Calamari <i>et al.</i> , 1991; Schreitmüller & Ballschmiter, 1995);
3,85	(Veith <i>et al.</i> , 1979; Mackay, 1982; Veith & Kosian, 1983; Chapman, 1989; Saito <i>et al.</i> , 1992; MacConnell <i>et al.</i> , 1993; Isnard & Lambert, 1988; Thomann, 1989; Ballschmiter & Wittlinger, 1991; Banejee & Baughman, 1991);
3,89	(Veith <i>et al.</i> , 1979; Zaroogian <i>et al.</i> , 1985);
3,90	(Elgar, 1983; Suntio <i>et al.</i> , 1988; Fischer <i>et al.</i> , 1993);
4,04	(Vigano <i>et al.</i> , 1992);
4,81	(Hawker & Connell, 1986);
5,32	(Sicbaldi & Finizio, 1993);
5,43	(Dao <i>et al.</i> , 1983);

**Coefficiente di ripartizione su carbonio organico (log K<sub>oc</sub>):**

1,14E <sup>-01</sup>	(Jury <i>et al.</i> , 1987b);
1,18	(USDA, 1989; Neary <i>et al.</i> , 1993);
2,38	(Kanazawa, 1989);
2,87	(McCall <i>et al.</i> , 1980);
2,96	(Hamaker & Thompson, 1972; Kenaga 1980a);
2,99	(Kishi <i>et al.</i> , 1990);
3,03	(Rao & Davidson, 1982; Lyman, 1982; Howard, 1991);

- 3,04 (Caron *et al.*, 1985; 20-25°C, Wauchope *et al.*, 1992; Dowd *et al.*, 1993; Lohninger, 1994; Hornsby *et al.*, 1996);
- 3,11 (Mackay & Stiver 1991; Jury *et al.*, 1984; Jury & Ohodrati, 1989; Spencer *et al.*, 1988; Spencer & Cliath, 1990);
- 3,47 (Chapman, 1989);
- 4,64 (calc., Mill *et al.*, 1980; Adams 1987);

#### Costante di Henry (Pa m<sup>3</sup>/mol):

- 5,0E<sup>-03</sup> (calc., Mackay & Leinonen, 1975; Suntio *et al.*, 1988);
- 1,8E<sup>-02</sup>-5,5E<sup>-01</sup> (calc., Mabey *et al.*, 1982);
- 246E<sup>-02</sup> (20°C, Montgomery, 1993);
- 4,86 E<sup>-02</sup> (20°C, Lyman *et al.*, 1990; Hemond & Fechner, 1994; calc., Thomas, 1982);
- 5,0E<sup>-02</sup> (calc., Lyman *et al.*, 1982; Suntio *et al.*, 1988);
- 1,0 E<sup>-01</sup> (calc., Ballshmiter & Wittlinger, 1991; Fischer *et al.*, 1991);
- 1,29 E<sup>-01</sup> (20°C, calc., Suntio *et al.*, 1988; Fendinger & Glotfelty 1988; Bacci *et al.*, 1990; Muller *et al.*, 1994);
- 1,58E<sup>-01</sup> (calc., Mackay *et al.*, 1986; Iwata *et al.*, 1993);
- 1,7E<sup>-01</sup> (calc., Calamari *et al.*, 1991);
- 1,87E<sup>-01</sup>, 7,4E<sup>-02</sup>-2,87 E<sup>-01</sup> (15°C, calc, Kucklick *et al.*, 1991);
- 2,03E<sup>-01</sup> (Fendinger & Glotfelty, 1988);
- 2,06E<sup>-01</sup> (Fendinger *et al.*, 1989);
- 2,2E<sup>-01</sup> (Atkins & Eggleton, 1971);
- 2,6E<sup>-01</sup> (calc., 10°C, Mclachlan *et al.*, 1990);
- 2,7E<sup>-01</sup>-3,2E<sup>-01</sup> (calc., Mackay & Shiu, 1981; Suntio *et al.*, 1988);
- 2,96E<sup>-01</sup> (calc., Howard, 1991);
- 3,1E<sup>-01</sup>, 3,5E<sup>-01</sup> (Kucklick *et al.*, 1991);
- 3,2E<sup>-01</sup> (24°C, calc., Chiou *et al.*, 1980);
- 3,22E<sup>-01</sup> (calc., Jury *et al.*, 1984; Jury & Ghodrati, 1989; Spencer *et al.*, 1988; Spencer & Cliath 1990; calc., Taylor & Glotfelty, 1988);
- 3,53E<sup>-01</sup>, 1,02E<sup>-01</sup>-3,58E<sup>-01</sup> (25°C, Kucklick *et al.*, 1991);
- 1,49E<sup>-01</sup> (Ryan *et al.*, 1988);
- 1,496, 1,334 (Caron *et al.*, 1985);

#### Tempo di dimezzamento nel suolo (giorni):

400 (Wauchope *et al.*, 1992)

#### DISTRIBUZIONE AMBIENTALE:

Il modello di Mackay (livello I) suggerisce la seguente distribuzione (moli) nei comparti ambientali:

COMPARTO	% di Distribuzione
Aria	2,53
Acqua	44,69
Suolo	26,63
Sedimenti	24,86
Solidi sospesi	0,04
Biomassa acquatica	0,01
Biomassa vegetale	1,24
<b>Somma delle moli introdotte</b>	<b>100</b>

## **PARAMETRI TOSSICOLOGICI:**

### **Alge EC50 (mg/L):**

1-5 (RIVM, 1994);  
3,2 (72h, *S. subspicatus*, inib. crescita, Schäffer *et al.*, 1994);  
4 (72h, *C. reinhardi*, inib. crescita, Schäffer *et al.*, 1994);  
4,22 (24h, *C. fusca*, inib. ripr., Faust *et al.*, 1993);

### **Alge NOEC (mg/L)**

1,4(72h, *S. subspicatus*, Schäffer *et al.*, 1994);  
1,6 (72h, *C. reinhardi*, Schäffer *et al.*, 1994);  
1,9 (RIVM, 1994);

### **Daphnia LC50 (mg/L)**

1,95E<sup>-02</sup>-5,16E<sup>-01</sup> (RIVM, 1994);  
4,6E<sup>-01</sup> (48h, *D. pulex*, Verschueren, 1996);  
5,0E<sup>-01</sup> (riproduzione, Deneer *et al.*, 1988);  
5,16E<sup>-01</sup> (48h, prod. tec., Verschueren, 1996);  
5,52E<sup>-01</sup> (48h, Fliedner, 1997);  
1,25 (26h, Frear & Boyd, 1967);

### **Daphnia NOEL (mg/L)**

1,5E<sup>-01</sup> (16d, NOEC crescita, Deneer *et al.*, 1988);

### **Pesci LC50 (mg/L)**

2,0E<sup>-03</sup>-4,47E<sup>-01</sup> (RIVM, 1994);  
1,0E<sup>-02</sup>-4,4 (WHO, 1975);  
6,2E<sup>-02</sup>, 6,0E<sup>-02</sup>, 4,4E<sup>-02</sup>, 1,31E<sup>-01</sup> (96h, bluegill, r. trout, catfish, goldfish, Verschueren, 1996);  
1,6E<sup>-01</sup>-3, 0E<sup>-01</sup> (48h, guppies, Tomlin, 1997);

### **Api LD50 (µg/ape)**

4,5E<sup>-01</sup> (orale, RIVM 1994);  
7,6E<sup>-01</sup> (orale, Stevenson, 1978);  
2,0E<sup>-01</sup> (contatto, Stevenson, 1978);  
2,0E<sup>-01</sup> (contatto, RIVM 1994);

### **LOMBRICHI LC50 (14d, mg/Kg suolo su *E. foetida* o *E. andrei* se non altrimenti specificato)**

59 (RIVM, 1994);  
135 (Hogger & Ammon, 1994);

### **Uccelli LD50 (mg/kg peso corporeo)**

122 (RIVM, 1994);  
120-130 (b. quail, Tomlin, 1997);  
50-200 (WHO, 1975);

### **Uccelli LC50 (mg/kg dieta)**

425->5000 (RIVM, 1994);

### **Mammiferi LD50 orale (mg/kg)**

88-270, 59-246 (ratto, topo, Tomlin, 1997);  
88-225 (ratto, WHO, 1975);

**Mammiferi LD50 dermale (mg/kg)**

900-1000 (ratto, Tomlin, 1997);

900-1000 (WHO, 1975);

**Mammiferi NOEL (dieta)**

25, 50 (2y, ratto, cane, mg/kg dieta, Tomlin, 1997);