TOXICOLOGICAL PROFILE FOR ISODRIN

Criteria and Standards Division
Office of Drinking Water
U.S. Environmental Protection Agency
Washington, DC 20460

August 1989

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FOR

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ISODRIN

A. GENERAL

1. CAS Number: 465-73-6

2. RTECS Number: IO1925000

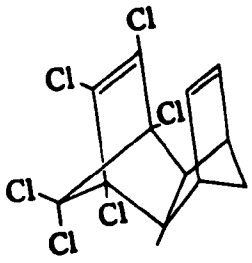
3. General Name/Synonyms: 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-endo,endo-5,8-dimethanonaphthalene

   1,8,9,10,11,11-Hexachloro-2,1-7,8-endo-2,3-7,6-endo-tetracyclo[6.2.1.$1^{3,6}$.$0^{2,7}$] dodeca-4,9-diene

4. Molecular Formula: $C_{12}H_8CL_6$

5. Molecular Weight: 364.93

6. Structure:



B. PHYSICAL AND CHEMICAL PROPERTIES

1. State: Crystals — Sax (1975)

2. Vapor Pressure: No information was found.

3. Melting Point: 241°C — Sax (1975)

4. Boiling Point: Decomposes above 100°C — Sax and Lewis (1987)

5. Specific Gravity: No information was found.

6. Solubility: No information was found.

7. Log K_{ow}: No information was found.

8. UV Absorption: No information was found.

C. PHYSICAL/CHEMICAL EQUILIBRIUM FACTORS

1. Bioconcentration Factors (BCF): No information was found.

2. K_{wa}: No information was found.

3. K_{oc}: No information was found.

D. ENVIRONMENTAL FATE

1. Photolysis: No information was found.

2. Leaching: When compared with several other chlorinated insecticides, isodrin was considered very mobile in Congaree sandy loam soil during a 13-year period (Nash and Woolson, 1968). Core sampling showed that approximately 15, 25, 27, 22, and 11% of the total isodrin residues were found at depths of 3.8, 11.5, 19.1, 26.7, and 34.3 cm below the soil surface, respectively. The authors noted that 16% of the isodrin in the original foliar application and 22% of isodrin incorporated into the soil were recovered from the soil after 12 years.

3. Route of Water Contamination: Water and sediment samples collected from 11 sites along the Mississippi River were contaminated with isodrin, endrin, and, in one case, endrin ketone, that originated from

both agricultural and industrial sources (Barthel et al., 1969). Levels of isodrin near industrial plants were considerably higher (up to 24,000 ppm) than those obtained at other sites (generally less than 35 ppm). However, chlorinated pesticide levels did not increase during a 3-year observation period.

4. Hydrolysis: No information was found.

5. Plant Uptake: Very low levels (0.60 ppm or less) of endrin and endrin ketone, byproducts of environmental degradation of isodrin, were detected in a variety of standing agricultural crops, including cotton, soybeans, sorghum and sorghum stalks, corn stalks, and "pasture." Concentrations of endrin found in cotton stalks were approximately 6.26 ppm. Samples were collected from 729 sites across the United States (Carey et al., 1978).

6. Microbial Degradation: No information was found.

7. Persistence in Soil/Water: Nash and Woolson (1967) and Nash et al. (1973) reported that approximately 15 to 25% of the nominal levels of 25 or 100 ppm isodrin incorporated into Congaree sandy loam soil remained 14 to 20 years after treatment. Analysis of soil samples 1 year after insecticide application showed isodrin residues of 33.5 and 155 ppm for the low- and high-dose concentrations, respectively. At 20 years postapplication, the corresponding residue levels (including endrin and its derivatives) were 6.5 to 7.5 and 30 to 39 ppm. Disappearance of isodrin from the soil occurred in a linear fashion. The authors stated that under the conditions of the experiment, leaching, volatilization, mechanical removal, and biological degradation were kept to a minimum. However, after 14 years, 95% of the soil residues from isodrin were present as endrin and endrin derivatives.

Using data from a series of field studies, Adams (1967) estimated that isodrin has a half-life of 0.5 to 1.0 years when applied to soil. The author assumed that the disappearance of isodrin followed a logarithmic pattern and that activities normally associated with pesticide loss from soil (e.g., volatilization, leaching, sorption, chemical and microbial degradation, and plant removal) occurred.

Carey et al. (1978) reported that among 1,486 soil and crop samples from 37 States, only 3 (0.2%) contained isodrin; concentrations ranged from 0.01 to 0.02 ppm. Endrin was detected in 14 (0.9%) of the samples at levels of 0.02 to 1.00 ppm.

Concentrations of isodrin in water and sediment collected from 11 sites along the Mississippi River did not appear to increase during a 3-year observation period despite discharges of high levels (up to 24,000 ppm) of the chlorinated pesticide from one manufacturing plant (Barthel et al., 1969)

8. Byproducts: Essentially all (at least 95%) of the isodrin (nominal levels of 25 and 100 ppm) applied to Congaree sandy loam soil was degraded to endrin and endrin conjugates within 14 years (Nash and Woolson, 1967; Nash et al., 1973). At 20 years postapplication, the predominant metabolite, endrin ketone, accounted for about 51 and 75% of the residues from the low- and high-dose treatments, respectively. Endrin accounted for approximately 15 to 22%. Other compounds identified in the 20-year-old samples were endrin aldehyde$_1$, endrin aldehyde$_3$, endrin alcohol, and dieldrin.

9. Vaporization: No information was found.

E. ACUTE TOXICITY IN MAMMALS

Animal/strain/sex	Route	LD_{50} (mg/kg)	Reference
Rat/Sherman/M	Oral	15	Gaines (1969)
F	Oral	7	
Rat/Sherman/M	Dermal	35	Gaines (1969)
F	Dermal	23	

F. SKIN AND EYE IRRITATION AND SENSITIZATION IN MAMMALS

No information was found.

G. SUBCHRONIC TOXICITY IN MAMMALS

No information was found.

H. REPRODUCTION AND TERATOGENICITY IN MAMMALS

No information was found.

I. MUTAGENICITY/GENOTOXICITY

In a dominant-lethal assay, negative results were obtained in Swiss mice administered isodrin orally (1.5 mg/kg, five doses) or intraperitoneally (1.3 or 6.4 mg/kg, single dose) (Epstein et al., 1972).

J. CHRONIC/CARCINOGENICITY STUDIES IN MAMMALS

No information was found.

K. PHARMACOKINETICS IN MAMMALS

Approximately 12.5% of a single oral dose of [^{14}C]photoisodrin (5 mCi/mmole), a photo conversion product of isodrin, was absorbed from the gastrointestinal tract of two male Swiss-Webster mice within 4 days after administration of the test material (Reddy and Khan, 1977). The 4-day cumulative levels of radioactivity in urine and feces were 10 and 82% of the ^{14}C administered, respectively. Individual tissue ^{14}C levels, including those of organs of the digestive system, were very low (i.e., less than 0.7% of the administered dose/g tissue) at 4 days posttreatment. In the urine and feces, about 4.6 and 75% of the administered dose, respectively, were organosoluble; the remaining ^{14}C (5.5 and 6.75%) was water-soluble. Organic extracts of urine contained unchanged parent compound plus one unidentified metabolite; fecal extracts contained photoisodrin plus five additional metabolites. The aqueous extracts of urine and feces contained three and four metabolites, respectively, but no [^{14}C]photoisodrin. In subsequent in vitro studies, microsomal fractions from the liver of male mice were incubated with [^{14}C]photoisodrin (1.70×10^5 dpm/mg) for 2 hours (Reddy and Khan, 1977). Ether extracts from this experiment contained approximately 33% of the total radioactivity, which was divided among five metabolites (1.3 to 7.2% each) and unchanged test material (17.8%). (The authors reported that radioactivity levels in the aqueous extract were too low for additional analysis.) Thus, metabolism of photoisodrin appeared to be mediated by hepatic mixed-function oxidase.

Endrin was the sole product of the in vitro metabolism of 2.5×10^{-5} M isodrin by albino rat liver microsomes (Nakatsugawa et al., 1965). NADPH was

required for optimal epoxidation of isodrin; epoxide production also was observed in the presence of $NADH_2$ but did not occur in the presence of other (i.e., oxidized) cofactors such as NADP or NAD.

L. HUMAN HEALTH EFFECTS

No information was found.

M. EXISTING STANDARDS/CRITERIA

No information was found.

N. REFERENCES

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