

The Photodecomposition of Dieldrin Residues in Water

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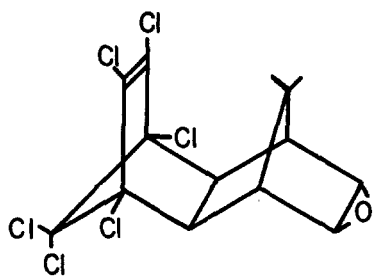
Recent investigations have shown that dieldrin (I) and aldrin (II) can be degraded by both laboratory ultraviolet light and sunlight. Robinson (2) and Rosen (4, 5) reported that dieldrin and aldrin undergo isomerization to compounds III and IV, respectively, when exposed to laboratory ultraviolet light (2537 Å) or to sunlight. Earlier, Roburn (3) had reported III as an unknown compound which was present on grass treated with dieldrin and exposed to sunlight.

Our laboratory has reported that dieldrin and aldrin can be mono-dechlorinated by the action of 2537 Å ultraviolet light to form compounds V and VI, and we have detected the photoisomer III on corn leaves treated with dieldrin and exposed to sunlight (1).

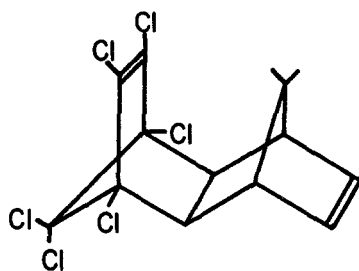
In continuing this work we now find that trace amounts of dieldrin suspended in water can be photolyzed to form photo-product III in good yield.

Methods and Materials

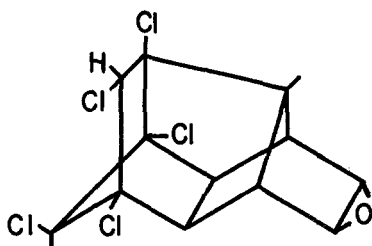
Purified dieldrin (2 g.) was placed in a 2-liter glass-stoppered flask and the flask was filled with distilled water. The mixture was agitated for two hours on a shaking table and



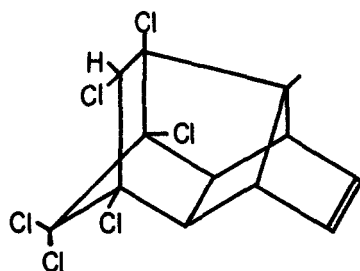
I



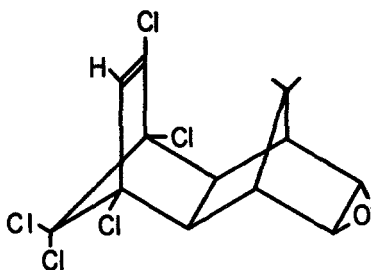
II



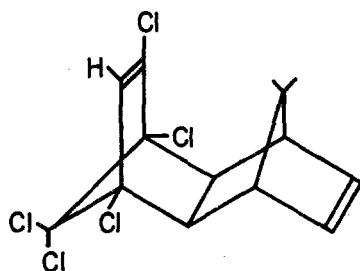
III



IV



V



VI

subsequently allowed to stand for two weeks. The dieldrin-saturated solution then was filtered through Whatman No. 1 filter paper into two 250-ml. round-bottomed quartz flasks fitted with 19/38 ground glass stoppers under spring tension. Both flasks were stoppered and one was inverted, clamped to a ring stand, and placed outdoors in sunlight. The other flask was placed in the dark to serve as a control.

After three months, the contents of each flask was extracted five times with 250-ml. portions of nanograde benzene. The benzene extracts were reduced to 10 ml. by rotary evaporation and analyzed by gas chromatography with a Varian-Aerograph Model 204 instrument equipped with an electron capture detector. The samples and standards were chromatographed on two columns:

Column A, 6-foot x 1/8-inch o.d. Pyrex glass column packed with 10% DC-200 silicone oil on 110/120 mesh Anakrom ABS at 200°C. and a nitrogen flow rate of 50 ml./minute; Column B, 6-foot x 1/8-inch o.d. Pyrex glass column packed with 5% XE-60 silicone oil on 70/80 mesh Chromosorb G at 190°C. and a nitrogen flow rate of 50 ml./minute.

The observed photoproduct was compared by cochromatography with a purified sample of III generously provided by Dr. Robinson.

Results and Discussion

Table I shows the compounds detected, their retention times, and the amounts detected. The photoproduct III, found only in the solution which had been exposed to sunlight, represented the

major part of the dieldrin originally present. It cochromatographed with the standard, and no other products (such as aldrin diol) were observed.

TABLE 1
Chromatographic Data for Dieldrin and Photoisomer III

Compound	<u>Retention Time (min.)</u>		<u>Amount Present (ppm.)</u>	
	Column A	Column B	Dark Reaction	Sunlight Exposure
Dieldrin	9.4	3.2	0.51	0.14
Photoisomer	23.4	22.6	0.00	0.32

None of the pentachloro photoproduct V was found in either the control or sunlight irradiated solution. It is apparent that residues of dieldrin can be photoisomerized while present either as a solution (or fine suspension) in water or as a deposit on plant surfaces.

References

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4. J. D. ROSEN, D. J. SUTHERLAND and G. R. LIPTON, Bull. Environ. Contam. and Toxicol. 1, 133 (1966).
5. J. D. ROSEN and D. J. SUTHERLAND, ibid, 2, 1 (1967).