Abstract

Photochemical Behaviour of Chlorobiphenyls (PCB)

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It has been shown previously (1) that 2,2',4,4',6,6'-hexachlorobiphenyl, when irradiated at 3100 Å in hexane and methanol solutions, photolyses rather readily to give products which are formed by stepwise loss of chlorine, rearrangement and condensation. "Polar" products whose structures were not further investigated were also observed.

We have now begun a systematic study of the photochemical behaviour of chlorobiphenyls with emphasis on two areas.

(i) Relationship between the structure of chlorobiphenyl isomers and their photochemistry. A series of isomers including compounds which are major components of commercial PCB preparations are being used.

(ii) Influence of irradiation conditions on the nature and amounts of products formed. In this study pure chlorobiphenyl isomers as well as commercial PCB preparations are being used and the effect of natural sunlight and a number of artificial light sources is being investigated. The irradiations are carried out in the vapour phase, in aqueous suspension, hexane methanol and aqueous dioxane solutions and with thin films of undiluted material.

Relatively large amounts of dechlorinated compounds were among the decomposition products in all experiments. With pure

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isomers, newly formed chlorobiphenyls were separated and characterized by TLC and GLC/Mass Spec. techniques. Changes in the commercial PCB preparations, on the other hand, were observed mainly by their altered GLC patterns.

Significant amounts of polar materials were formed when air and water were present during the irradiations. Chromatographically, some of these polar compounds behave similar to hydroxychlorobiphenyls whoreas others may be carboxylic acids and polymers. The structures of these compounds which are now under investigation will be discussed as will be conditions for their formation.

The fact that polar products are formed from chlorobiphenyls under the influence of UV radiation could be important from several points of view. Hydroxychlorobiphenyls and related polar materials may no longer show the toxicity that is associated with chloroaromatic hydrocarbons. These compounds may also be more readily degraded by microorganisms in the environment. Hydroxychlorobiphenyls on the other hand may also be important as intermediates in the environmental formation of toxic chlorodibenzofuranes. Experiments designed to evaluate this possibility are underway and will be described.

(1) S. Safe and O. Hutzinger. Nature, 232, 641 (1971).