Persistence of BHC in River Water in the Kitakyushu District, Japan, 1970-1974

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Environmental contamination by the organochlorine pesticides such as BHC, DDT, and cyclodiene compounds has become of interest to many reseachers. The extensive survey on pesticide residue in river waters was initiated by the establishment of the surveillance system by U. S. Department of the Interior, Federal Water Pollution Control Administration, and various reports have been published by many reseachers [i.e., BREIDENBACH and LICHTENBERG (1963), WEAVER *et al.* (1965), and BREIDENBACH *et al.* (1967)]. Recently, SCHULZE *et al.* (1973) reported the levels of the organochlorine pesticide in the streams of the Western United States during 1968 and 1971, and DDT was the most frequently detected insecticide in their results. Also KAHANOVITCH and LAHAV (1974) reported that the most widespread compounds in the water samples of Israel were gamma-BHC and alpha-BHC, and concluded that municipal sewage was an important source of BHC residue in the water bodies.

WHEATLEY and HARDMAN (1965) detected the gamma-BHC, dieldrin, and DDT residues in rain water of Great Britain. Also these residues in rain water of the Hawaiian Islands were reported (BEVENUE *et al.* 1972).

In the previous papers (SUZUKI *et al.*1972 and 1974), the authors reported the seasonal and yearly variation of BHC residue concentration in river water and tap water in the Kitakyushu District, Japan. The purpose of this paper is present the BHC concentration in the downstream portions in two major rivers of the Kitakyushu District during 1970 and 1974.

METHODS

Sample collection

Water samples were collected at the two Sampling Stations which located on downstreams of the Onga River

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and the Murasaki River. The pictures of these two rivers are follows:

River	Length	Catchment
Onga River	60.7 km	1,032 km^2
Murasaki River	20.0 km	120 km^2

The water samples were collected in the middle of each month,provided no rain had fallen three days before sampling and the collected samples were stored at 1-2°C until analysis.

Extraction

Pesticides in the water samples were extracted according to a previous report (SUZUKI *et al.* 1974).

Gas Chromatographic Analysis

The quantitative and qualitative measurements of each BHC isomer were made with a Shimadzu Model GC-5AIEE equipped with a dual electron capture detector and a dual detection system. The following columns (3 mm in inner diameter and 2 m in length, Pyrex® U-shaped glass column) and operational conditions were employed; i) 5% Apiezon grease L on dimethyldichlorosilane-treated Gas Chrom Q, 80-100 mesh. The injector, column, and detector temperratures were 220, 215, and 215°C, respectively. A flow rate of high purity nitrogen carrier gas was 120 ml/min. ii) 2% silicone OV-17 and 2% silicone OV-210 on dimethyldichlorosilane-treated Chamelite CS, 80-100 mesh. The injector, column, and detector temperatures were 220, 215, and 215°C, respectively. A flow rate of high purity nitrogen carrier gas was 30 ml/min.

RESULTS AND DISCUSSION

Persistence of BHC residues in the Onga River and the Murasaki River is shown in Figures 1 and 2, respectively. In these Figures, BHC concentrations showed a similar tendency. After use of BHC insecticide on the field was prohibited in late 1970, yearly maximum concentrations which are shown in summer, logarithmically decreased durring 1970 and 1972. But these concentrations were not greatly changed afterwards.

KAHANOVITCH and LAHAV (1974) detected 142.6 ng/l of total BHC and 119.0 ng/l of gamma-BHC in surface water

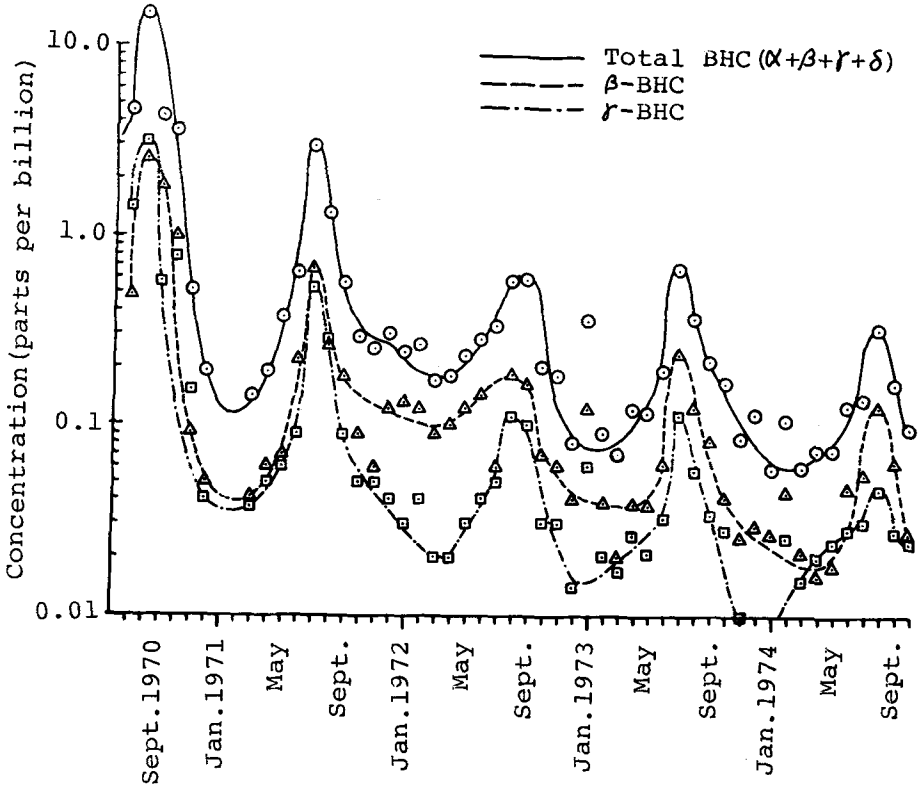

Fig. 1. Persistence of BHC in surface water samples taken at Onga River, Kitakyushu.

of the Jordan River in Israel, in which country gamma-BHC had been applied to arable land. However in our results, total and gamma-BHC residue levels in summer 1974, 4 years after ban of its use, were 307 ng/l and 46 ng/l at Onga River sampling station, and were 252 ng/l and 72 ng/l at Murasaki River, respectively. These total BHC levels were about two times higher than in Israel. Those results indicated that the BHC had been applied in great quantity to the environment of Japan against pests for more than twenty years, and a considerable amount remained in the soil (SUZUKI *et al.* 1973).

The variation of pesticide concentrations in river water was introduced by run-off water from the paddy fields and by the volatilized pesticides from soil. These phenomena generally occurred in the environment, so that the BHC concentration was much higher in summer than in autumn and winter. From 1972 to 1974, the maximum BHC concentrations in river water were at almost the same levels; this was because of the environmental dissipation of BHC residues in the field.

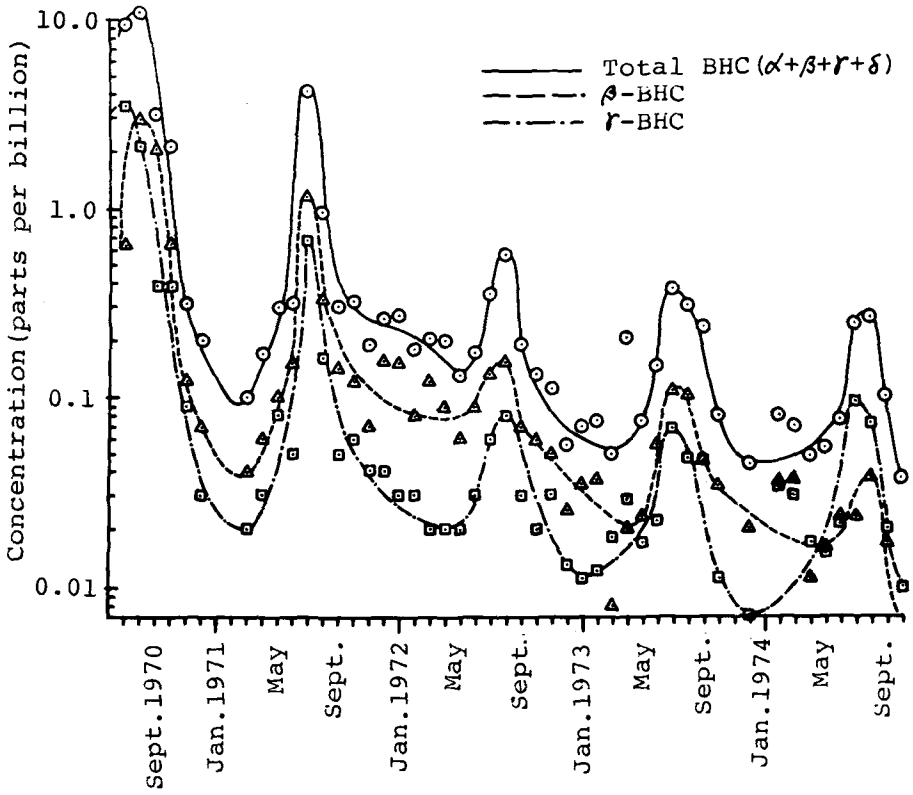

Fig. 2. Persistence of BHC in surface water samples taken at Murasaki River, Kitakyushu.

The minimum concentration shown in winter of every year have not varied greatly throughout the investigation. From these results, the residue level in river water was influenced by weather, temperature, or other environmental conditions. The maximum total BHC concentrations shown in summer, was 7 to 8 times higher than minimum concentrations.

Buffering actions between sediments and waters were generally considered in an estuary and lower part of river (JOHNSON and BALL 1972), it seems necessary to monitor the BHC concentration on these areas.

REFERENCES

BEVENUE, A., J.N. OGATA, and J.W. HYLIN: Bull. Environ. Contam. Toxicol. 8, 238(1972).

BREIDENBACH, A.W., and J.J. LICHTENBERG: Science 141, 899(1963).

BREIDENBACH, A.W., C.G. GUNNERSON, F.K. KAWAHARA, J.J. LICHTENBERG, and R.S. GREEN: Publ. Health Rep. (U.S.) 82, 139(1967).

JOHNSON, H.E, and R.C. BALL: Fate of Organic Pesticides in Aquatic Environment, ed. by Faust, Washington, D.C.: American Chemical Society, 1972.

KAHANOVITCH, Y. and N. LAHAV: Environ. Sci. Technol. 8, 762(1974).

SCHULZE, J.A., D.E. MANIGOLD, and F.L. ANDREWS: Pestic. Monit. J. 7, 73(1973).

SUZUKI, M., Y. YAMATO, and T. AKIYAMA: Kogyo Yosui No.166 22(1972).

SUZUKI, M., Y. YAMATO, and T. WATANABE: Bull. Environ. Contam. Toxicol. 10, 145(1973).

SUZUKI, M., Y. YAMATO, and T. AKIYAMA: Wat. Res. 8, 643(1974).

WEAVER, L., C.G. GUNNERSON, A.W. BREIDENBACH, and J.J. LICHTENBERG: Publ. Health Rep. (U.S.) 80, 481(1965).

WHEATLEY, G.A. and J.A. HARDMAN: Nature 207, 486(1965).