# PCT, PCB and Pesticide Residues in Human Fat and Blood

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As descrived in the previous papers in this series (DOGUCHI et al 1974 ; DOGUCHI and FUKANO 1975), substantial amounts of PCTs were detected in human fat and blood. Especially, the levels of PCTs were almost equivalent to those of PCBs in human blood. In the end of 1960 or begining of 1970, the levels of total DDT in human fat were the same order of magnitude in Japan and other countries, but the levels of BHC in Japanese, especially of β-BHC, were 10 to 20 times higher than the levels found amoung the populations of other countries compaired(DOGUCHI et al 1970).

Our interest in the pollution by these substsnces led us to analyze the residues levels of PCTs, PCBs, DDT and BHC in human fat of 30 samples collected in 1974 in an atempt to compaire with the levels found in 1971 and to obtain additional information with PCT pollution. We also mentioned the residues of PCTs and PCBs in the blood collected again from 10 subjects in 1975 out of 27 subjects who had been already examined in 1973 to obtain some measure of changes in these residue status with time.

## Materials and Methods

Thirty samples of the adipose tissues, 18 males and 12 females, obtained in Tokyo in 1974 were subjected to the analyses of PCTs, PCBs, DDT and BHC. Human blood were collected again from 10 subjects in 1975 out of 27 subjects from whom blood were obtained to estimate PCT and PCB levels in 1973(DOGUCHI and FUKANO 1975). Determinations of PCTs and PCBs were made with these blood samples.

The residues of PCTs, PCBs and pesticides in the fat were extracted with hexane-acetone(1:1) and cleaned up by fuming sulphuric acid treatment and column chroma-



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tography on florisil and silica gel. Elution of DDT and BHC with hexane containing 6% of ether followed elution of PCTs, PCBs and DDE from the column with hexane. Subsequent procedures, gas chromatography and quantitation, were the same as descrived previously(DOGUCHI and FUKANO 1975).

The analyses of PCTs and PCBs in the blood were made according to the method descrived in preceding paper(DOGUCHI and FUKANO 1975).

The contents of ortho, meta and para terphenyl in human fat and in KC-C, technical PCT product, were determined by treating them with $SbCl_5$ to yield perchlorinated terphenyls(DOGUCHI et al 1974) and by compairing the peak hights of these isomers with those of authentric samples on mass fragmentgrum of parent mass number(m/e = 714). GC-Mass instrumental conditions were as follows : Shimazu-LKB 9000 system was used with a 100 X 3 mm glass column packed with 2% OV-1 on 80/100 mesh Gas Chrom Q. The operating conditions were : column temperature, 280°C ; flow late of herium, 30 ml/min ; trup current, 60 μA ; ionization voltage, 70 eV.

## Results and Discussion

The average levels of PCTs and PCBs in human fat were 1.11 ppm and 1.04 ppm on fat basis and respective standard deviations were 2.01 ppm and 0.59 ppm. Neither significant difference nor correlation were demonstrable statistically between the levels of PCTs and PCBs in human fat.

Table 1. Levels of PCTs and PCBs in Human Fat

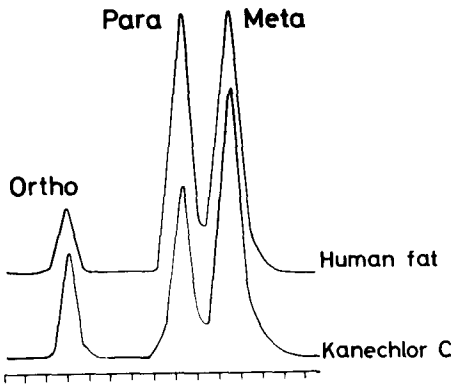
| | PCT Residues | PCB Residues |
|---|---|---|
| No. of Samples | 30 | 30 |
| Mean Value | 1.11 | 1.04 |
| Range | 0.04 - 9.20 | 0.38 - 2.50 |
| S.D. | 2.01 | 0.59 |

( ppm on fat basis)

The peak profiles in the chromatograms of human fat and blood were quite similar to that of KC-C, as shown in previous papers(DOGUCHI et al 1974 ; DOGUCHI and FUKANO 1975). However, it was evidenced that the composition of PCTs in the fat was somewhat different from

that of KC-C : the contents of ortho, meta and para isomers in the PCT residues in human fat were 8% ± 0.5, 47 % ± 1.4 and 45% ± 1.0 ( n=4 ), and those in KC-C were 9%, 58% and 33% respectively. Metabolic behaviour or decomposition in the environment might be influenced by structural features.

Fig. 1. Mass Fragmentograms on m/e = 714 of Tetradeca Chlorinated Terphenyls in Human Fat and KC-C




With all subjects but one, no definitive changes as regards the levels of both PCTs and PCBs in the blood were recognizable between 1973 and 1975.

Table 2. Residue Levels of PCTs and PCBs in Human Blood Collected from Same Subjects in 1973 and 1975 ( ppb on whole blood basis)

| Age | Sex | PCT Residues 1973 | PCT Residues 1975 | PCB Residues 1973 | PCB Residues 1975 |
|---|---|---|---|---|---|
| 24 | F | 19.6 | 8.4 | 4.0 | 1.8 |
| 28 | M | 11.8 | 9.4 | 3.0 | 2.0 |
| 23 | F | 7.8 | 7.6 | 2.3 | 2.2 |
| 44 | M | 7.2 | 8.0 | 2.5 | 2.5 |
| 26 | M | 7.0 | 8.4 | 3.1 | 2.9 |
| 29 | M | 4.8 | 4.4 | 3.0 | 2.4 |
| 25 | F | 2.6 | 2.7 | 3.2 | 3.8 |
| 32 | M | 1.9 | 2.0 | 3.5 | 3.7 |
| 29 | M | 1.1 | 1.1 | 2.2 | 1.9 |
| 28 | M | 0.7 | 1.2 | 5.1 | 2.7 |

The studies made by us(USHIO and DOGUCHI in press) on the diet and by other investigators(MINAGAWA and TAKIZAWA 1975 ; NISHIMOTO et al 1973) on the food stuffs revealed that the PCT residues in food were so low as to be practically negligible. In general population, ingestion of the residues in food is thought to be the major route by which persistent environmental pollutants enter into the body. However, as descrived above, the levels of PCTs in human fat and blood were shown to be almost equivalent to PCBs, despite negligible amount of PCTs was found in food. These facts led us to presume extremely longer period of biological half time of PCTs and/or other route responsible for accumulation of PCTs in human body than the route through ingestion of PCT residues in food.

Table 3. Pesticide Residues in Human Fat
( 30 subjects, ppm on fat basis )

| | α-BHC | β-BHC | γ-BHC | Total BHC | p,p'-DDE | p,p'-DDT | Total DDT |
|---|---|---|---|---|---|---|---|
| Average | 0.015 | 2.32 | 0.026 | 2.36 | 2.91 | 0.68 | 3.59 |
| Max. | 0.064 | 5.41 | 0.131 | 5.43 | 6.20 | 1.44 | 7.64 |
| Min. | nd | 0.16 | 0.003 | 0.16 | 0.21 | 0.20 | 0.41 |
| S.D. | 0.012 | 1.42 | 0.031 | 1.42 | 1.61 | 0.33 | 1.87 |

The mean concentration of total BHC was 2.36 ppm and that of DDT was 3.59 ppm in human fat collected in 1974, as shown in table 3. About 98% of BHC was present in the form of β-BHC and 80% as DDE. The average level of BHC in 1971 on 27 subjects(DOGUCHI et al 1970) was 3.19 ppm and that of DDT was 3.60 ppm. The statistical analyses could not show any significant difference between the levels of DDT in 1974 and 1971, but lower level of BHC was demonstrated significantly in 1974. It was shown that the concentration of BHC in human milk tended to decrease gradually ; the level in 1973 reduced to about 1/2 of the level in 1969, but no changes were recognizable on the levels of DDE(YAKUSHIZI et al 1975). The results on human fat and milk suggest that BHC residues in human body are decreasing in Japan.

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