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Residual Status after Parturition of Methylsulfone Metabolites of Polychlorinated Biphenyls in the Breast Milk of a Former Employee in a Capacitor Factory

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YOSHIDA and NAKAMURA (1977a, 1977b) showed that methylsulfone metabolites were present in the milk of a woman who had handled polychlorinated biphenyls (PCBs) in a capacitor factory for four years. Methylsulfone metabolites were also detected in her omentum fat as well as in her subcutaneous fat. The levels of methylsulfones were estimated at one-twentieth of those of PCBs in the respective samples. This occupationally-exposed woman had excreted milk for 16 months after parturition. By collecting the milk, we measured the levels of PCBs* and methylsulfones at the same time.

This paper will describe the changes of the levels in accordance with time and GC patterns of methylsulfone metabolites for 16 months. Comparison of the gas chromatograms of methylsulfones from the Baltic grey seal (*Halichoerus grypus*) and the human milk will be also clarified.

EXPERIMENTAL

Milk samples were continuously collected from a mother after parturition for 16 months. She had formerly been employed in a capacitor factory handling Kanechlor (KC) 300 and 500 for four years. Fat extract from the Baltic grey seal blubber was supplied from Dr. JENSEN, Stockholm University. Analytical methods for milk and fat used the method of YOSHIDA and NAKAMURA (1977b).

Gas Chromatographic Analysis

Tissue extracts were analysed on a Varian 2100 equipped with an electron capture (Ni^{63}) detector (ECD-GC). The column was equipped with a 2m x 2mm i.d. glass column packed with 2 % OV-17 on Gas Chrom Q (100/120). Column and detector temperature were 270° and 300°, respectively.

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* PCB levels were formerly reported by YAKUSHIJI *et al.* (1976).

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Quantitative determination was made by the total peak height of the methylsulfone region in the chromatograms comparing with the authentic standard, *i.e.* 2,5,2',5'-tetrachlorobiphenyl-4-methylsulfone.

RESULTS AND DISCUSSION

PCBs ingested with the food by experimental rats, mice and minks are considered to be metabolized to phenolic and/or conjugated forms and to methylsulfone type metabolites *in vivo* (JANSSON *et al.* 1975, MIO *et al.* 1976, JENSEN *et al.* 1976). With respect to metabolism of PCBs in human bodies, the phenolic metabolites and conjugated ones are difficult to detect because these are readily excreted.

Methylsulfones, however, are accumulated in the adipose tissues and easily detectable in the fat due to their lipophilic character in contrast to the phenolic metabolites.

Table 1 shows the levels of PCBs and methylsulfones in the breast milk of this mother. Fig. 1 shows the changes in accordance with time in residual status of the methylsulfones in the milk.

TABLE 1

Residual Levels of PCBs and Methylsulfones in Breast Milk

Date	Concentration (ppm)	
	PCBs	Methylsulfone PCBs
12. Aug. 1975	14	0.59
6. Sept.	15	0.77
29. Oct.	15	0.74
18. Dec.	11	0.61
13. Feb. 1976	8.3	0.37
15. Apr.	8.1	0.17
15. Jun.	4.6	0.22
4. Aug.	4.4	0.17
15. Nov.	3.7	0.15

(Fat basis in beast milk)

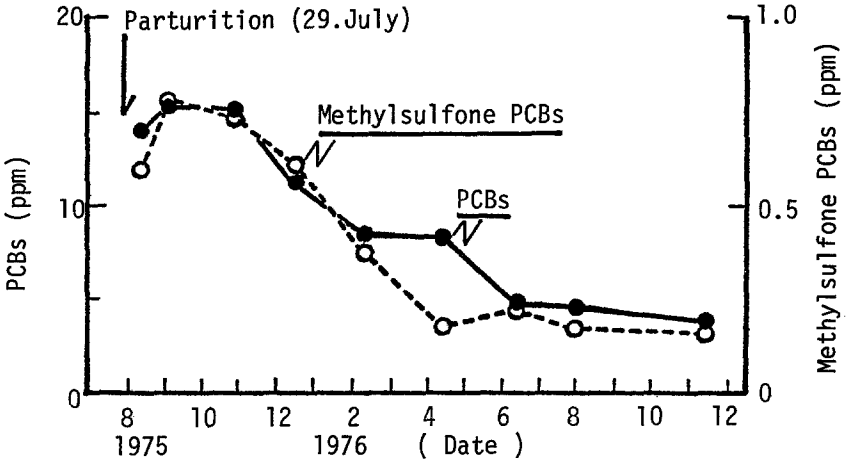

Fig. 1 Residual status of PCBs and methylsulfone PCBs in mother's milk after parturition (conc.;ppm,fat basis).

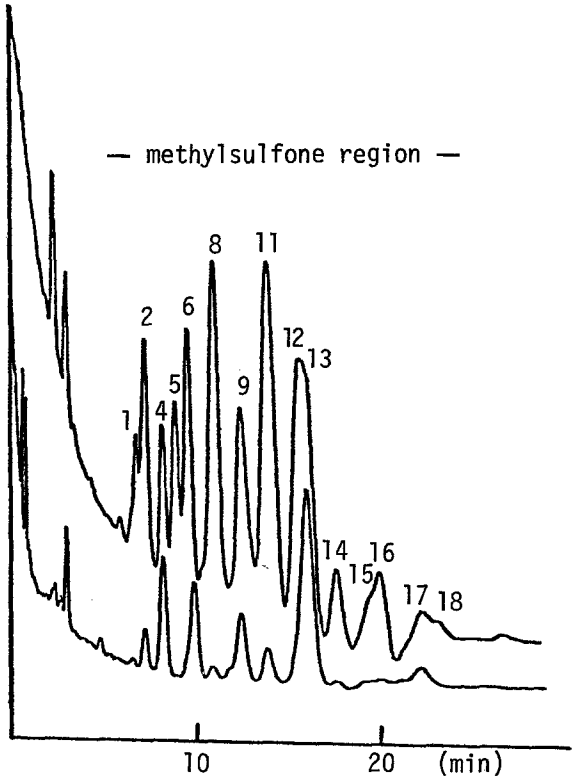

Fig. 2 Comparison of ECD-gas chromatograms of methylsulfone PCBs in Baltic seal blubber (upper) and mother's milk (lower). GC conditions are described in the text.

After the parturition on 29 July 1975, the level on 6 Sept. subsequently indicates the maximum concerning with methylsulfones as well as PCBs. The ratio of methylsulfones to PCBs were approximately one-twentieth on the respective months. YOSHIDA and NAKAMURA (1977b) reported that omentum fat and subcutaneous fat also had this ratio.

Fig. 2 shows the gas chromatograms of methylsulfone region obtained from the Baltic grey seal (upper) and mother's milk (lower). The peaks in the methylsulfones region numbered in the chromatogram are the same as those of the report of JENSEN (1976). Several peaks in this region were identical to those from seal.

According to JENSEN (1976), these peaks in the chromatogram from seal were composed with tri-, tetra-, penta-, hexa- and hepta-chlorinated methylsulfones. And we clarified that composition of these methylsulfone type PCBs in mother's milk were found to be tetra-, penta- and hexa-chlorinated compounds by mass fragmentography in the earlier paper. Nevertheless, we failed to detect a trace of the methylsulfone type DDE found in seal samples by JENSEN (1976).

As to the comparison of the compositions of PCBs and methylsulfones in mother's milk, the lower chlorinated compounds among the PCBs had found to change a little during 16 months, while the patterns of methylsulfones are not varied during these intervals.

Since the original food with which PCBs are taken is different between seals and human beings, the pattern of methylsulfones of PCB should be further investigated with respect to PCB pattern analysis by the method previously reported (JENSEN and SUNDSTRÖM 1974, NAKAMURA and KASHIMOTO 1977).

These methylsulfone metabolites are considered to be formed via arene oxide and oxidatively metabolized with inducing of methylthio group (SUMINO and MIO 1976).

Detailed metabolic pathways of PCBs and toxicological implications of these methylsulfonated compounds, however, are still left unknown. Further investigations on the points mentioned above would be required.

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