

PCDD/F, PCB AND HEXACHLOROBENZENE LEVELS IN HAIR

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Introduction:

Organochlorine compounds like PCDD/F, PCB and Hexachlorobenzene accumulate in human body due to their highly lipophilic properties. Once there, they can cause cancer and have adverse effects on the endocrine, immune and nervous system (1). Body burden measurements can help to find some correlation between adverse health effects and exposure to those environmental toxicants. Analysis of adipose tissue, blood and breast milk are commonly used to evaluate human exposure (2).

Hair analysis is frequently used in drug testing, but regarding organochlorine pollutants only few papers handle this topic (3).

In order to obtain some indication about the concentration range of dioxins and dioxin-like compounds hair samples were analysed. Also the relative amount of some selected congeners was compared with what was found in completely different kinds of samples.

Materials and Methods:

All hair samples were taken from the same person (male, age 37, slight overweight) at different times. The influence of the hair being washed was considered too. Approximately 10 g of hairs was cut to small pieces, spiked with internal standards and extracted by ASE with toluene. After sulphuric acid pre-treatment samples were processed using multistep clean up on an automated sample clean up apparatus (Power Prep, FMI). Determination of PCDD/F, PCB and Hexachlorobenzene was performed by isotopic dilution on a HRGC/HRMS Finnigan Mat 95 XL system using a DB 5ms GC column (J&W).

Results:

Table 1 summarises the dioxin/furan results. The congener profiles were quite different from what is usually found in breast milk or blood samples (2). For example the ratio between 1,2,3,7,8 PCDF and 2,3,4,7,8 PCDF is close to 1:2, whereas this ratio in blood samples is at least 1:10. The congener pattern found in hair is similar to what is found in skin lipid (4) and correlate also with that found in environmental samples like ambient air samples (5) or spruce needles (6).

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Table 1:
Concentration of PCDD/F in hair sample April-01 (pg/g)

CONGENERE	WHO-TEF	
2378 TCDD	1	<0.2
12378 PCDD	1	0.3
123478 HxCDD	0.1	<0.5
123678 HxCDD	0.1	<0.5
123789 HxCDD	0.1	<0.5
1234678 HpCDD	0.01	3.2
OCDD	0.0001	22.5
2378 TCDF	0.1	0.4
12378 PCDF	0.05	0.2
23478 PCDF	0.5	0.5
123478 HxCDF	0.1	<0.5
123678 HxCDF	0.1	<0.5
234678 HxCDF	0.1	<0.5
123789 HxCDF	0.1	<0.5
1234678 HpCDF	0.01	1.3
1234789 HpCDF	0.01	<0.5
OCDF	0.0001	3.2
WHO-TEQ in pg/g		0.71

Also the PCB pattern relates to this kind of samples. The ratio of PCB#77 to PCB#126 is close to 5:1 as you can see in table 2. This may indicate that hair analysis give also some information about environmental conditions. There could be also some influence when hair was washed. Some hair grease bounded pollutant will be removed by washing. This variable should be taken in account when approaching hair analysis.

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Table 2: Concentration of PCBs and Hexachlorobenzene in hair samples (pg/g)

COMPOUNDS	WHO-TEF	Sampling time		
		November-00	February-01	April-01 (a)
Hexachlorobenzene		1385	1553	1428
PCB#77	0.0001	25.5	24.0	22.7
PCB#126	0.1	4.8	4.4	3.6
PCB#169	0.01	1.4	1.5	1.3
PCB#81	0.0001	<1	<1	<1
PCB#105	0.0001	256.6	305.8	249.0
PCB#114	0.0005	35.0	39.1	32.1
PCB#118	0.0001	1107.4	1253.3	896.4
PCB#123	0.0001	20.3	19.3	9.5
PCB#156	0.0005	379.4	388.0	247.1
PCB#157	0.0005	65.7	60.2	44.6
PCB#167	0.00001	114.5	123.2	75.4
PCB#189	0.0001	35.8	45.9	21.8
WHO-TEQ in pg/g		0.88	0.87	0.66

(a) Hair was washed thoroughly before sampling

Conclusions:

It seems that hair analysis of organochlorine pollutants can give some information about the environmental conditions of where the person lives. They can work as passive sampler like spruce needles. The congener profile indicates that body accumulation via food assumption may not be the only way these compounds are transferred to hair.

References:

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