TIME- AND TISSUE-DEPENDENT PCB REISDUES AFTER EXPOSURE TO CONTAMINATED SOIL

Kanjana Imsilp and Larry G. Hansen

College of Veterinary Medicine, University of Illinois, 2001 S. Lincoln Ave, Urbana, IL 61802

Introduction

Although over 100 PCBs (of about 150 congeners found in commercial products[1]) can be detected in human and environmental samples, very few congeners; e.g. PCBs 138, 153 and 180 are commonly reported[2, 3, 4]. Those congeners with TCDD equivalent effects (such as PCBs 77and 126) also are frequently reported, even though present at very low proportions. Less reported congeners are those which disappear shortly after exposure due to elimination. Different PCBs can cause different biological responses due to their capability to interact with numerous receptors[5] and the disappearance from biological samples differs; thus, the determination of PCB composition in the target species (at multiple sites) will be useful in assessing risk to human and environmental health, especially when multiple tissues are retrieved from the same organism at different times.

Materials and Methods

Samples for PCB analysis were collected from an ongoing study done in age-matched Crl:SKH1-hrBR hairless mice that were exposed to either control or PCB/PCDF-contaminated soil[6]. Ear skin was biopsied from each mouse and weighed at the termination of contaminated soil exposure (week 11). Samples were collected once again at the termination of the study (week 48). Multiple tissues were collected and weighed including ear skin, trunk skin, inguinal fat pad and liver.

All tissue samples were extracted using 5 x 1 mL hexane:acetone (1:1). The extracts were cleaned by alumina (2% deactiveated) column chromatography and dried with sodium sulfate. The extracts were eluted using 20 mL hexane. The hexane eluate was then concentrated and exchanged to isooctane (final volume of 1 mL). Samples (1 μL) were injected onto a Hewlett Packard Gas Chromatography 6890N system equipped with a 60 m x 0.25 mm x 0.25 μm DB-5 capillary column, a micro electron capture detector, and an Agilent Chemstation software. Five standard congener mixtures (Accustandard®, Inc., New Haven, CT) were used to establish multilevel calibration curves for 141 PCB congener analysis. The limits of quantification and detection were 5.0 and 2.5 ng/mL respectively.

Results and Discussion

Residues in the ear samples collected immediately after PCB exposure (week 11) were composed of both persistent and episodic congeners in which both types contributed a high percentage to the total PCB (Table 1). However, the episodic congeners were highly decreased or absent at week 48 (37 weeks after exposure) in similar tissue and also in different tissues of the same animal. Thus, the contribution of most of the persistent congeners was increased (Table 1). However, the livers of the mice were significantly enlarged and PCB 118 was metabolized as an episodic congener by the induced enzymes.

Table 1. PCB residues presented as the percentage of total PCB in different tissues.

PCB congener	% of total PCB				
	Ear (wk 11)	Ear (wk 48)	Skin (wk 48)	Fat Pad (wk 48)	Liver (wk 48)
16/32	2.67				
17/15	1.99				
18	1.20				
22	2.80				
26	0.92				
28	8.62				
31	3.13				
40	0.81				
42	1.77				
44	2.96				
45	0.89				
47	2.56				
49	1.96				
52	3.65				
60	3.30				
64/41	2.04				
66	4.66				
70	3.73				
71	0.89				
74	2.94				
77	0.29				
84	0.58				
95	1.26				
99	1.66				
101/90	1.92				
105	2.23				
110	1.49				
114		0.37	0.35	0.36	
115	1.51				
118	4.41	0.47		0.09	
128	0.43				

Table 1. (Continued)

PCB congener	% of total PCB				
	Ear (wk 11)	Ear (wk 48)	Skin (wk 48)	Fat Pad (wk 48)	Liver (wk 48)
130	0.47			0.12	
138	7.98	12.36	9.15	8.03	11.39
141	0.41				
146	0.63	0.83	0.81	0.69	
149	1.31				
153	5.64	12.16	10.73	9.39	10.07
156	0.73	6.61	5.66	5.14	6.04
157		1.12	0.98	0.76	1.57
158	3.42				
167				0.06	
170	2.01	10.25	10.18	2.50	9.20
171				5.62	2.22
172	0.43	2.99	3.01	2.60	2.43
174	0.21	0.19			
177	0.25	0.37		0.14	
178	0.48	2.08	2.09	1.88	2.80
180	3.45	27.67	30.42	30.39	29.07
183	0.58	1.54	1.50	1.34	1.84
187	0.91	2.19	2.03	1.83	1.33
189				0.94	
190				2.41	2.62
191	0.75			0.08	
193		1.99	2.16	1.90	2.14
194	0.42	7.38	9.31	9.91	7.57
195				0.77	
199	0.66	7.57	9.28	9.12	7.85
203		1.86	2.34	2.37	1.85
205				0.53	
208				0.88	
209				0.16	
Total PCB (ng/mg)	347.46	21.70	13.35	56.04	2.27

The means of total amount of PCB residues accumulated in the ear tissue after 11-week exposure was higher than 4-week exposure observed in another study. This indicates time-dependent bioaccumulation of PCB residues during continuing exposure regardless of the type of congener.

The differences in mean amount of PCB in investigated tissues indicate differences in accumulation and elimination among targets of a biological system. The accumulation was highest in the fat pad while lowest in the livers. The results were consistent with other studies[7, 8, 9] which suggested subcutaneous fat and skin as storage sites for PCBs. Therefore, the accumulation of PCB residues is also tissue-dependent. Ear skin can be used as a biopsy, especially if notching is used for identification.

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