

Levels of Brominated Diphenylethers in Serum of Teenagers

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Introduction. PBDEs in human blood were first measured early in the 1990s. The highest levels of these compounds in human blood are reported in North America (She *et al.*, 2002; Petreas *et al.*, 2003). Levels reported range between sub nanogram and several tens of ng per g of lipid. Usually BDEs 47 and 153 appear to be the dominant congeners (see e.g. Li *et al.* 2005). The relation between daily intakes and serum levels is not straightforward. Decrease in daily intakes lowered the serum levels of PCBs in younger generation, but not in the older one. The body burden may change as a function of age, BMI, fish consumption, number of parity and breastfeeding (Koizumi *et al.* 2005). Levels of PBDEs seem not correlated with the levels of PCDDs/Fs and PCBs. Levels of PCBs still exceed the PBDE levels (Birnbaum & Staskal, 2004). However in the future this could be different considering the fact that PBDEs are still produced nowadays.

A study in the Netherlands in Groningen reported quite low levels in serum. In this study BDE-153 was most commonly detected (in 76 individuals) and was about 10 pg/g serum. BDE-209 was detected in 11 of the 91 serum samples. BDE-28 was only detected in one individual, BDE-47 in 40 individuals, BDE-99 in 23 individuals, BDE-154 in 19 individuals and BDE-183 in 10 individuals (5.6 pg/g fat) (Meijer *et al.*, 2004).

The present study is part of a longitudinal cohort study on the influence of exposure to background levels of dioxins on average, healthy children (Leijs *et al.*, 2006). Previously the subjects, now aged 14-19 years, were studied during their neonatal (n=60) (1), toddler (2) and pre-pubertal period (n=44) (3,4). From the original cohort, 32 children consented and participated to the current follow-up study. All of the children were born in the Amsterdam/Zaandam region of The Netherlands.

Materials and methods. Current PBDE exposure was determined using GC-MS. To that end, blood samples of 200 ml were obtained by vena puncture. Samples were spiked with six ¹³C-labeled internal PBDE standards. After spiking the lipid fraction was isolated by liquid-liquid extractions using diethyl ether and petroleum ether respectively. The lipids were redissolved in 10 ml dichloromethane and transferred to the top of a Carbosphere column (fraction 1). Hereafter, the Carbosphere column was placed in a reflux unit and refluxed for 2h with 20 ml dichloromethane (fraction 2). Next, the column was rinsed with 20 ml toluene (fraction 3) and thereafter refluxed with 20 ml toluene for 1 h (fraction 4). Next the Carbosphere column was turned upside down and refluxed for 16 h in 40 ml toluene (fraction 5). Fractions 1-3 were combined and contain the mono and diortho PCBs together with the BDEs. Fraction 4 represents the planar PCBs and fraction 5 represents the PCDD/PCDF fraction. The fractions were evaporated to dryness. The PBDE fractions were then cleaned-up over acid-base and neutral

alumina. PBDEs were separated on a 30 m DB-1 column and identified and quantified using low resolution MS (single quad, Trace/ Thermoquest).

Results. Recovery experiments showed that tetra to hepta-BDE congeners are mainly found in fractions 1 and 2 of the Carbosphere column reflux/extraction procedure with recoveries ranging between 80 and 97%. Some minor recoveries were found in fraction 3. Recoveries of PBDEs from the alumina column varied between 98 and 120%.

Tetra- to hepta-BDE congeners could be identified in the blood of the teenagers. The quantitative results will be presented on the poster. Octa, nona and deca-BDE could not be quantified due to insufficient recovery of the internal standards, which can be due to the clean-up procedure (acid-base silica or to incomplete recovery from and degradation in the GC-column).

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References

- Birnbaum LS, Staskal, DF. 2004. Environ. Health Perspect 112, 9.
- Koizumi A, Yoshinaga T, Harada K, Inoue K, Morikawa A, Muroi J, Inoue S, Eslami B, Fujii S, Fujimine Y, Hachiya N, Koda S, Kusaka Y, Murata K, Nakatsuka H, Omae K, Saito N, Shimbo S, Takenaka K, Takeshita T, Todoriki H, Wada Y, Watanabe T, Ikeda M. 2005 Environ. Res. 99; 31.
- Leijds MM, Koppe JG, Olie K, de Voogt P, Vulsma T, van Aalderen WMC, Westra M, ten Tusscher GW .2006. Organohalogen Compounds 68, 968
- Li QQ, Loganath A, Chong YS, Obbard JP. 2005. J. Chromatogr. B, 819, 253.
- Meijer L, Peters RJB, Sauer PJJ. 2004. Report from website Greenpeace: www.Greenpeace.nl/reports.
- Petreas M, She J, Brown FR, Winkler J, Widham G, Rogers E, Zhao G, Bhatia R, Charles MJ. 2003. Environ. Health Perspect. 111, 1175.
- She J, Petreas M, Winkler J, Visita P, McKinney M, Kopec D. 2002. Chemosphere 46, 697.