

PCDD/F and PCB in Human Blood of Chimney Sweeper

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Introduction

118 chimney soot samples of the bavarian area were investigated in 1993 and 1994¹⁾ for PCDD/F. The detected concentrations were in the range of 4 to 42048.2 ng I-TE/kg (mean value 2802.33 ng I-TE/kg).

For this reason it must be assumed that chimney sweeper belong to the most exponated group. They were able to intake the PCDD/F with the chimney soot particles and as gaseous compounds. This increased uptake of PCDD/F could lead to higher concentrations in blood and fat and perhaps to injuries to health. Based on this knowledge 300 bavarian chimney sweeper were investigated for PCDD/F and PCB.

Materials and Methods

a) Sampling

About 3100 chimney sweeper were available in Bavaria. For a statistical interpretation of the results a collective of 300 chimney sweeper and a control collective of 60 persons were chozen. The selection of the chimney sweeper was done by the Bavarian chimney sweeper corporation. The blood taking was carried out by the institute and outpatient department for industrial, social and environmental medicine.

b) Extraction

The isolation of the blood fat was carried out by the method of Pöpke, Ball, Lis and Scheunert²⁾. The extraction solvent was n-hexane/propanol-2 3:2. After concentration of the extract a gravimetrical fat determination was done. Additional a clinical fat determination was carried out. Based on the sometimes different results the solvent was changed to n-hexane/propanol-2 1:3³⁾.

The 17 2,3,7,8-substituted carbon-13 PCDD/F and the ¹³C₁₂-PCB 28, 52, 101, 138, 153 and 180 were added before extraction.

c) Isolation of the PCDD/F and PCB

In figure 1 the scheme of the isolation of the PCDD/F and PCB was presented.

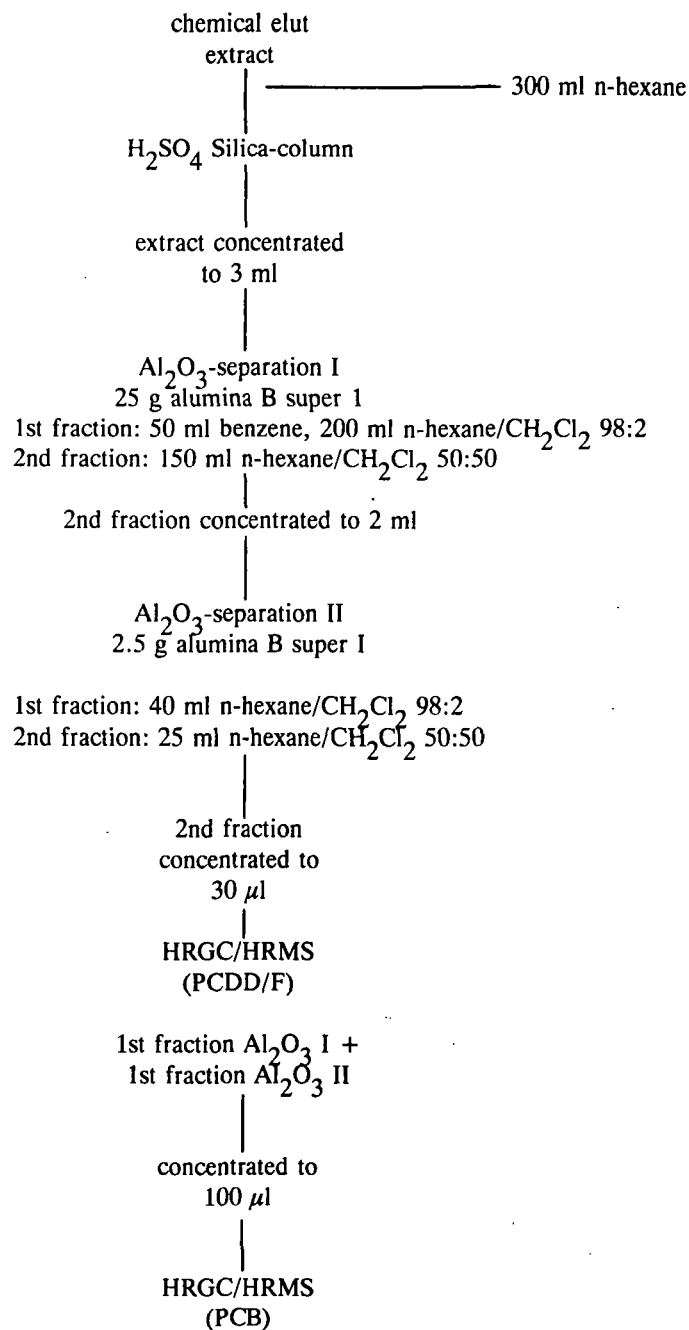


Figure 1: Isolation of PCDD/F and PCB from human blood

d) GC/MS-analysis

The PCDD/F and PCB analyses were carried out using HRGC/HRMS. The PCDD/F and PCB were quantified with the added internal standards.

Results and Discussion

a) Extraction efficiency

At the beginning of our studies the extraction of the human blood was done using chemical elut and the solvent n-hexane/propanol-2 3:2. The determined fat contents (gravimetric and clinical) differ upto a factor 5 and also the absolut contents of PCDD/F and PCB. This problem was solved changing the solvent to n-hexane/propanol-2 1:3. Now the gravimetric and clinical fat contents were very similar. But the results show also that the PCDD/F and PCB concentration related to the gravimetric fat content obtained from the two different solvents were very similar. Using the clinical fat determination as reference the extraction with n-hexane/propanol-2 1:3 must be done.

b) PCDD/F-results

Within the scope of our investigations 300 human blood samples of chimney sweeper and 60 human blood samples of a control group were analyzed for the 17 2,3,7,8-isomers. The results were converted to the international toxicity aequivalents (I-TE). The following table shows the min., max. and mean value concentrations.

blood sample	PCDD/F-concentration I-TE ng/kg fat		
	min. conc.	max. conc.	mean value
chimney sweep (n = 300)	3.40	73.19	17.88
control group (n = 60)	5.76	121.26	16.80

Table 1: min., max., and mean value concentrations in human blood

The comparison of these results show, that the chimney sweeper were only about 6.4% higher loaded than the control group. Obviously the PCDD/F which were adsorbed to the chimney soot were only desorbed to a very small percentage. The comparison of these data with the data of the literature⁴⁾ about the general german population show a very good conformity.

c) PCB-results

300 human blood samples of chimney sweeper and 60 blood samples of a control group were also analyzed for the PCBs 28, 52, 101, 138, 152 and 180. The concentrations of the 6 congeners were added. The min., max and average concentrations showed table 2.

blood sample	PCB-concentration $\mu\text{g}/\text{kg}$ fat		
	min. conc.	max. conc.	mean value
chimney sweep (n = 300)	54.468	4081.587	357.769
control group (n = 60)	19.118	636.448	313.667

Table 2: min., max. and mean value concentrations in human blood

These data show similar concentrations in the blood of the chimney sweeper and the control group. The professional exposition against incineration residues leads not to a relevant additional load.

Literature

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