

BIOMONITORING OF PCDD/F WITH HAIR

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Introduction

Monitoring of humans and their environment focussing on persistent bioaccumulative organic chemicals with toxicological potency (PBT) has become increasingly important for exposure and risk assessment. Body fluids and tissues are commonly in use to characterise human exposure for those compounds. The generation of samples normally requires the consultation of a medical doctor.

A general scheme of routes of exposure for human hair and potentially other hair is given in Figure 1.

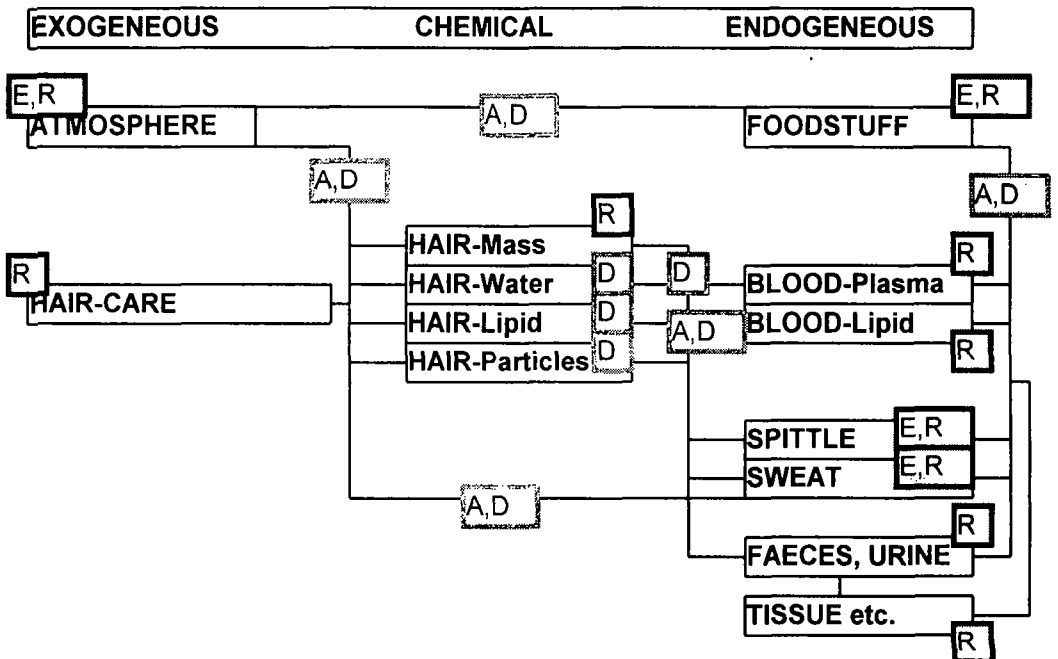


Figure 1: Scheme of the important sources (E), interactions between hair compartments and exogenous adjacent media (D-Diffusion, Dispersion, A-Advection) and processes (R-

Reaction), which contribute to the concentration of chemicals in the respective compartments

The results from blood and tissues generally do not reflect a temporal high exposure to PBT. Therefore other monitoring tools have to be considered. An attractive alternative could be the use of human and animal hair for exposure assessment^{1,3}.

Methods and Materials

Analytical procedures are given elsewhere^{1,2,3} and in detail for PDDD/F, polychlorinated biphenyls (PCB), and polycyclic aromatic hydrocarbons (PAH) by SCHRAMM⁴.

Biomonitoring of Polychlorinated Dibenzo-p-dioxins and Dibenzofurans (PCDD/F) at humans was performed by investigating the hair of humans at soldering workplaces.

Results and Discussion

The differences in between the cohort are obvious (Figure 2). Comparison with ambient air measurements show that hair analysis is more sensitive and informative than common air measurements.

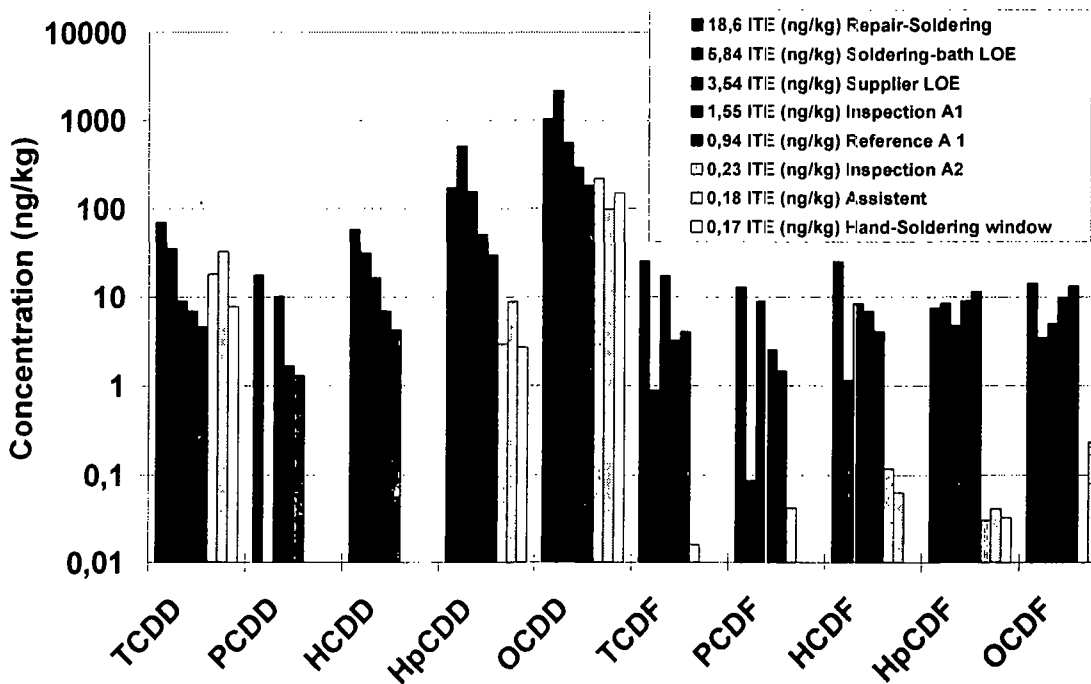


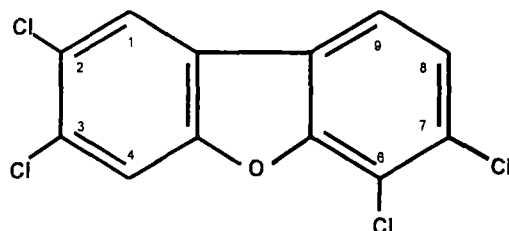
Figure 2: PCDD/F-hair-concentrations at soldering workplaces of different exposure

Further investigations at a highly polluted lake area in China showed similar pattern in fish and hair of fish consumers.

Similar results have been elaborated for PAH by comparing smokers and non-smokers as well as hair from animals (sheep). Experiments with a smoking machine show very clearly the high adsorption capacity of smoke constituents and the ability to identify patterns of cigarette smoke.

In addition it was found that PCDF with a substitution pattern shown in the figure exhibit similar persistence as the 2,3,7,8-substituted PCDF-congeners.

Figure 3: TCDF which are substituted in 3 lateral positions and in the neighbourhood of the single lateral position were found to be persistent in human hair and wildlife.



In conclusion hair monitoring is a non-invasive monitoring tool and becomes an increasingly suitable method to investigate the exposure of man and wildlife by semivolatile, bioaccumulative and persistent pollutants. In selected cases endogenous and exogenous pathways of the pollutants can be distinguished. Sensitive cohorts like children or protected animals can be investigated without any ethical restrictions.

References

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