

LONG-TERM SAMPLING METHOD FOR POLYCHLORINATED DIBENZOFURANS (PCDFs), DIBENZO(P)DIOXINS (PCDDs) AND FURTHER ORGANIC COMPOUNDS OF SIMILAR VOLATILITY IN FLUE GAS OF COMBUSTION FACILITIES

Funcke, W., Linnemann, H., Philipp, Ch.

GfA - Gesellschaft für Arbeitsplatz- und Umweltanalytik mbH,
Otto-Hahn-Straße 22, D-4400 Münster, Germany

Abstract

A long-term sampling method for PCDF/Ds¹, penta- and hexachlorinated benzenes (PCBzs) and tri- to pentachlorinated phenols (PCPhs) is presented. The samplings were performed over a four-week period using the adsorption method described recently². The results are in good accordance to those of four parallel one-week samplings. Potential break-through was not obtained in significant amounts.

Introduction

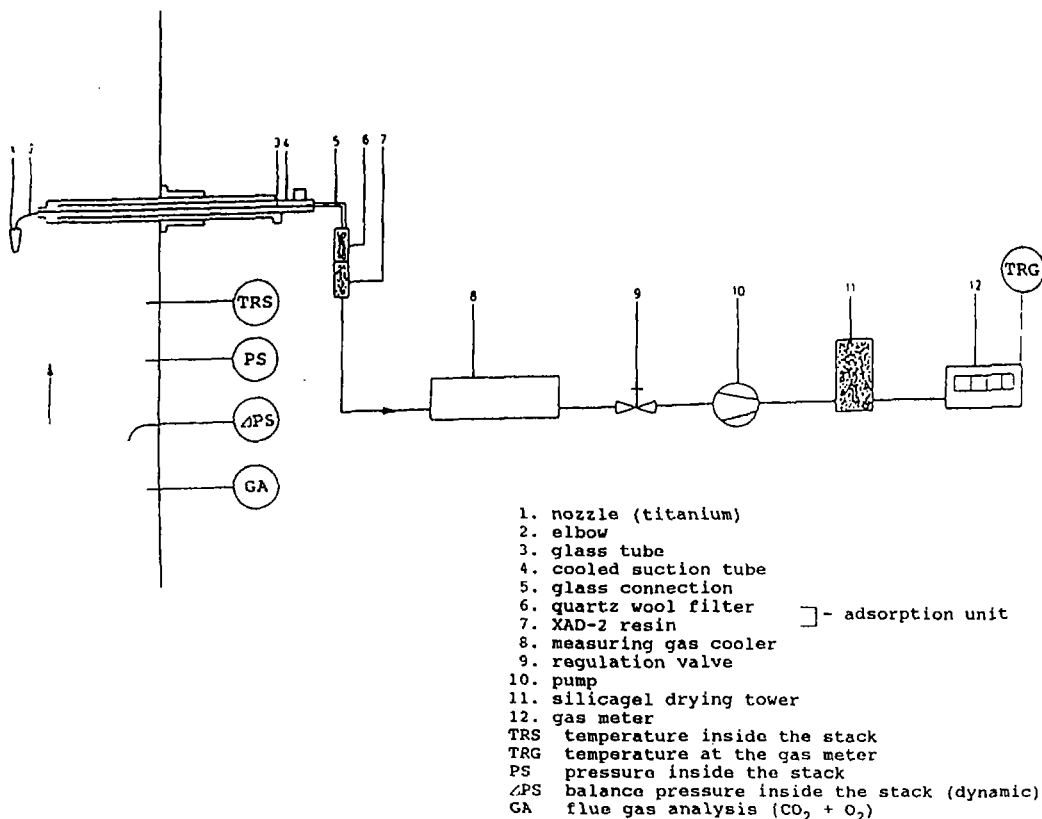
From 1988 to 1992 the GfA developed a sampling method for PCDF/Ds which was tested in more than 250 samplings at different combustion facilities¹. Based on this method a long-term sampling equipment for PCDF/Ds was elaborated². In this paper results are presented for PCBzs and PCPhs sampled by using this adsorption method over a four-week period. The results are compared to data obtained from four one-week samplings performed parallel to one four-week sampling.

Experimental

The sampling equipment is shown in Figure 1. The samplings were performed at a combustion facility with regular emissions of non-volatile organics, which was verified in more than 50 short-time measurements (6 hs).

The samples are worked-up and analyzed as described previously^{1,3}.

Figure 1: Sampling equipment



Results and Discussion

The results of the PCBz and PCPh analyses are presented in Table 1. For the sums of Penta- and HexaCBz, the sums of the 10 PCPhs as well as for the concentrations of individual substances the results of the four-week sample are all-most average values of the results of the four one-week samples.

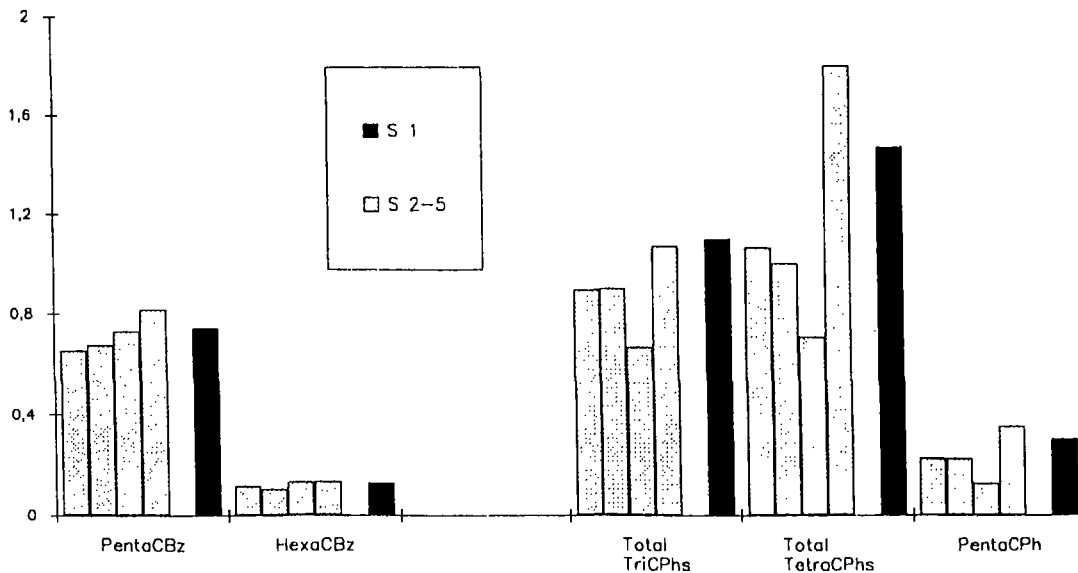
The results are also shown graphically in Figure 2.

Table 1: PCBz and PCPh concentrations obtained by one four-week (S 1) and four one-week samplings (S 2 - 5); Referred to: 0 °C, 1,013 hPa, dry

Sampling Period Sample Dimension	4 weeks S 1 ³ µg/m ³	1st week S 2 ³ µg/m ³	2nd week S 3 ³ µg/m ³	3rd week S 4 ³ µg/m ³	4th week S 5 ³ µg/m ³
PCBzs					
PentaCBz	0.7456	0.6563	0.6769	0.7318	0.8181
HexaCBz	0.1320	0.1180	0.1070	0.1344	0.1370
Total Penta- and HexaCBz	0.8776	0.7743	0.7839	0.8662	0.9551
PCPhs					
246-TriCPh	0.6377	0.4805	0.5709	0.4419	0.5595
236-TriCPh	0.0433	0.0410	0.0345	0.0256	0.0554
245-TriCPh	0.1501	0.1327	0.1111	0.0704	0.1604
235-TriCPh	0.0926	0.0770	0.0621	0.0456	0.1055
345-TriCPh	0.0215	0.0225	0.0166	0.0137	0.0238
234-TriCPh	0.1517	0.1456	0.1090	0.0714	0.1656
2356/2346-TetraCPh	1.3235	0.9379	0.9028	0.6481	1.6179
2345-TetraCPh	0.1451	0.1248	0.0972	0.0602	0.1819
23456-PentaCPh	0.3049	0.2278	0.2275	0.1286	0.3551
Total 10 PCPhs	2.8703	2.1898	2.1898	1.5055	3.2251

Not detected congeners are not included in the calculation of the totals

Figure 2: PCBz and PCPh concentrations (µg/m³) obtained by one four-week (S 1) and four one-week samplings (S 2-5); Referred to: 0 °C, 1,013 hPa, dry



ANA

Break-throughs are between 0.1 and 4.8 % for Penta- and HexaCBzs and 0.2 to 5.6 % for PCPhs and therefore negligible (Table 2).

Table 2: Percental portion of PCBzs and PCPhs in the back-up cartridges; the PCBz/PCPh concentrations in the adsorption unit are defined as 100 %.

Sampling Period Sample Break-through	4 weeks S 1 %	1st week S 2 %	2nd week S 3 %	3rd week S 4 %	4th week S 5 %
PCBz					
PentaCBz	1,0	4,4	2,1	0,7	< 0,1
HexaCBz	0,9	4,8	1,6	0,7	< 0,2
Total Penta- and HexaCBzs	0,9	4,5	2,1	0,7	< 0,1
PCPhs					
246-TricPh	0,6	0,7	0,7	0,8	0,4
236-TricPh	1,9	< 1,5	< 1,7	< 2,3	< 1,1
245-TricPh	1,1	2,9	1,5	3,1	1,0
235-TricPh	1,3	2,2	1,8	2,2	0,7
345-TricPh	5,6	3,6	< 3,6	< 4,3	< 0,4
234-TricPh	1,4	2,0	2,5	1,4	
2356/2346-TetraCPh	0,4	0,8	0,3	0,6	0,2
2345-TetraCPh	1,7	3,1	2,0	3,0	0,7
23456-PentaCPh	0,8	1,4	1,0	1,6	0,4
Total 10 PCPhs	0,7	1,2	0,8	1,0	0,3

Not detected congeners are not included in the calculation of the totals

The results presented here indicate that the sampling method described in Figure 1 can be used not only for long-term samplings of PCDF/Ds¹, but also for organic compounds with similar volatility like PCBzs and PCPhs.

References

- 1 Funcke W., Linnemann H., Philipp Ch. Long-term Sampling Method for Polychlorinated Dibenzofurans (PCDFs) and Dibenzodioxins (PCDDs) in Flue Gas from Combustion Facilities. *Chemosphere* 1993; in print.
- 2 Funcke W., Linnemann H. Sampling of Polychlorinated Dibenzofurans (PCDF) and Dibenzo(p)dioxins (PCDD) in Emissions from Combustion Facilities Using an Adsorption Method. *Chemosphere* 1992; 24: 1563-72.
- 3 VDI guideline 3499, part 2 (draft), Düsseldorf 1993.