

FATE AND CONCENTRATION OF DIOXINS/FURANS IN ENVIRONMENTAL SAMPLES NEAR INCINERATOR

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Introduction

Polychlorinated dibenzo-*p*-dioxins and dibenzofurans(PCDD/PCDFs) derived from various sources are emitted into the atmosphere where some of them disappear by Hydroxyl radical reaction^{1,2)} and photolysis and some translocated soils, sediments and water bodies by dry/wet deposition.³⁾ It is thought that the distribution change of PCDD/PCDFs is important during movement. PCDD/PCDFs emitted sources are partitioned into gaseous and particulate phases and their ratio depends on the vapor pressure of congeners. The deposition velocity of PCDD/PCDFs on soils and water bodies is influenced by the physical properties of gaseous and particulate phases so that the distribution of PCDD/PCDFs emitted sources are found not to be similar to those of (outside) in environmental samples. The fate of PCDD/PCDFs is being observed, the levels and distribution of those in sources and environmental samples was investigated.

Material and Method

Sampling location : For this study, flue gas of incinerator was obtained as source, atmosphere and soil sample as environmental sample from the same site. Two sources were selected showing different distribution of congeners to each other, and two atmosphere samples of urban area and one soil sample of rural area was selected as background. Atmosphere samples near hospital incinerator were obtained before and during the operation of the incinerator; so that the change of concentrations and distributions influenced by source could be observed. All the atmosphere samples were divided into gaseous and particulate phases and distribution of each was compared to that of environmental sample.

Samples Clean-up : Clean-up procedures were modified from the method of EPA 1613. After extraction, the samples were treated with concentrated sulfuric acid. Crude extract from every sample was further purified in silica-gel column and then basic alumina column, and finally, in activated carbon-impregnated silica-gel column chromatography.

Quantification: Determination of PCDD/PCDFs was performed by HRGC/HRMS on a Autospec Ultima mass spectrometer at a resolution of 10,000 in selected ion mode. Isomeric specific separation of PCDD/PCDFs was carried out on a SP-2331 capillary column. TEQs were calculated using I-TEFs for PCDD/PCDFs

Result and Discussion

Concentration : The concentration of PCDD/PCDFs from flue gas of paper mill incinerator was 29.97pg-TEQ/Nm³, level of atmosphere near paper mill was higher than that of urban. It was indicated that the environment near paper mill influenced incinerator to an extent that, the level of soils near paper mill, which was 9.75pg-TEQ/g, became higher than that of soils in suburbs. The concentration of PCDD/PCDFs for flue gas of hospital incinerator was very high, the reason was considered to be that this incinerator is a small one that hadn't sufficient APCDs. The concentration of PCDD/PCDFs for atmosphere samples near the hospital incinerator was that of the atmosphere during the operation of the incinerator and it was 0.469pg-TEQ/Nm³ which is higher than that of the atmosphere before operation of the incinerator by three times. But, the concentration of PCDD/PCDFs for soil samples near the hospital incinerator was detected to be 1.45pg-TEQ/g and was slightly higher than that of suburbs. Accumulation of PCDD/PCDFs on soils is little because the hospital incinerator was not always operated.

Table 1. Sample information

label	Atmosphere(pg/Nm ³)					Incinerator(pg/Nm ³)		Soil(pg/g dw)		
	A-1 ^a	A-2 ^a	A-3 ^b	Urban 1	Urban 2	I-1 ^a	I-2 ^b	S-1 ^a	S-2 ^b	suburb
isomer	n=2	n=2	n=1	n=1	n=1	n=4	n=2	n=8	n=3	n=1
PCDFs	1.312	5.822	3.673	1.046	0.827	163.485	440761.9	66.041	12.824	2.162
PCDDs	0.898	4.945	1.748	0.828	0.285	886.938	76017.5	68.793	20.418	11.201
Total	2.210	10.768	5.422	1.874	1.112	1050.423	516779.4	134.834	33.242	13.363
TEQ	0.150	0.469	0.287	0.165	0.168	29.969	78830.0	9.747	1.447	0.804

^a : sample near hospital incinerator

^b : sample near paper mill incinerator

A-1 is a sample before operation of hospital incinerator, A-2 is a sample during operation of hospital incinerator.

Fate of PCDD/PCDFs derived from hospital incinerator : The distribution of PCDD/PCDFs emitted hospital incinerator dominated dibenzofurans. The most dominant homologues were 5F and 4F in PCDFs. But the distribution of PCDD/PCDFs for atmosphere during operation of incinerator was similar to that for ambient air as shown in figure 1. The pattern of PCDD/PCDFs for ambient air disappeared to reflect source. So far another known source could not be detected the hospital incinerator. OCDD was dominated in the distribution of PCDD/PCDFs for soils that was similar to ambient air rather than flue gas of incinerator. This corresponds the fact that the PCDD/PCDFs of the atmosphere transfer to soils and water bodies through the process of dry and wet deposition.

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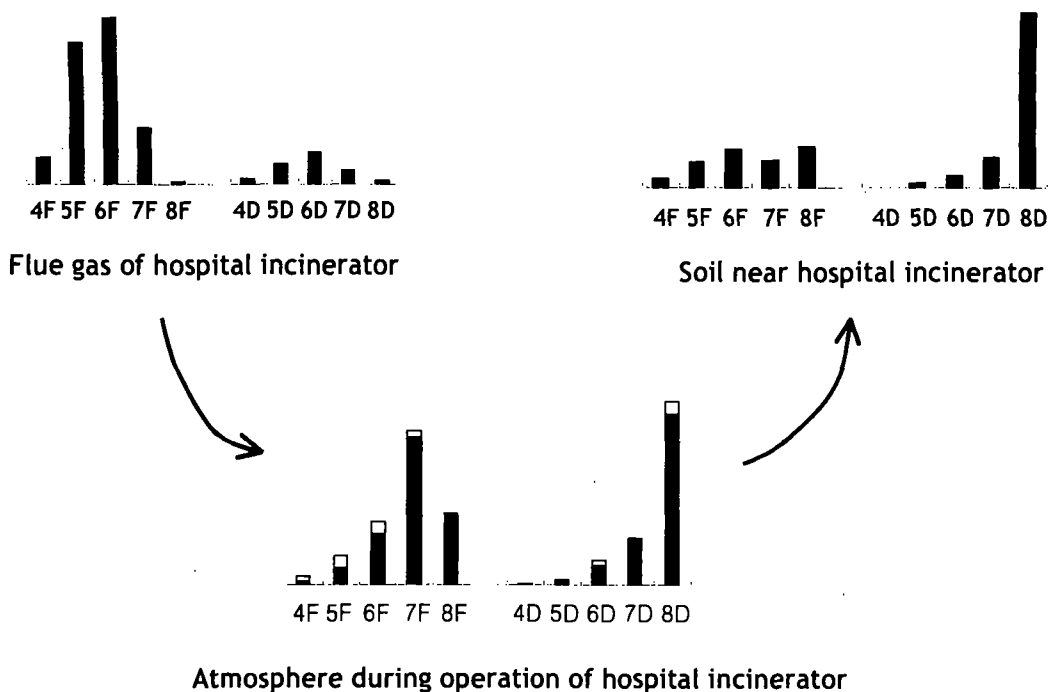


figure 1 homologue of PCDD/PCDFs near hospital incinerator

Fate of PCDD/PCDFs derived from paper mill incinerator : The results of the distribution of PCDD/PCDFs derived from paper mill incinerator was that PCDDs was higher than PCDFs, OCDD was especially dominant, this is different from the case of the hospital incinerator. But, the distribution of PCDD/PCDFs for atmosphere near paper mill incinerator corresponded with the distribution near the hospital incinerator and urban area. The homologue pattern of soils and atmosphere had many point in common though 6F was detected highly in soils and because of this, it was thought that another source had existed in the industrial area.

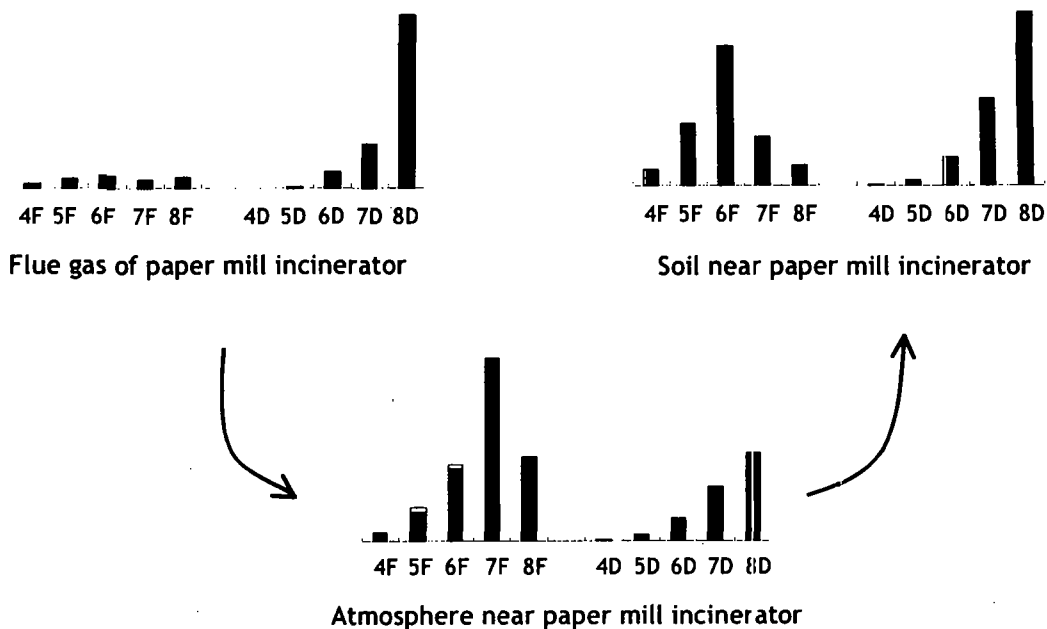


Figure 2. Homologue of PCDD/PCDFs near paper mill incinerator

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