

Environmental Levels (Air and Soil) of Other Organohalogenes and Dioxins P305

A Study on the distribution of PCDDs/Fs in the leachate of open landfill site

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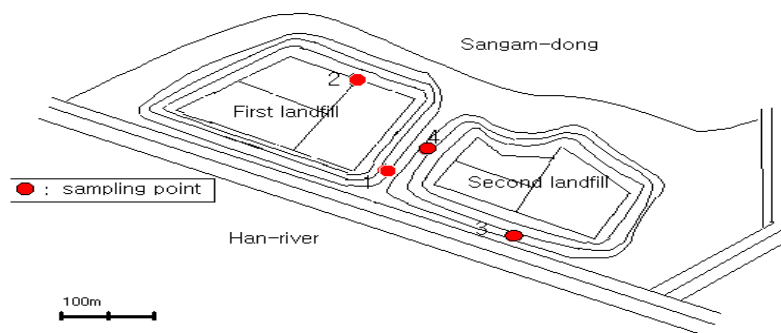
Introduction

Polychlorinated dibenzo-p-dioxins(PCDD) and dibenzofuran (PCDF) are ubiquitous environmental pollutants. There have been major concerns about the distribution of PCDDs/Fs congeners from environment because of the most toxic and persistent of environmental contaminants. The Nanjido landfill site which is located within Seoul city boundary is the biggest one among the finished landfills in Korea. But it has caused many pollution problems including leachate, because various wastes have been simply disposed at Nanjido landfill site without sanitary treatment systems and installation to keeping it from polluting around from 1978 to 1993.

Thus, the purposes of this study is to show the concentration and composition of PCDDs/Fs in leachate of the Nanjido landfill site in Seoul city.

Material and Method

The leachate was sampled at four sites in the Nanjido landfill from November 1998 to April 1999. Figure 1 shows sampling position in the Nanjido landfill. Samples collected at site 1 is internal leachate and site 2, 3, and 4 are external leachates.



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Fig 1. Sampling position at the Nanjido Landfill

The Filtrates (1L) were extracted with 200ml of dichloromethane for 20min in a separaor funnel, 2 times, respectively. The dichloromethane extract was concentrated to nearly dryness with rotary evaporator at 40 °C, 900mbar. Filter fiber and material particle filtered were extracted by soxhlet apparatus with toluene for over 16hr, 5cycle/hr and were concentrated to nearly dryness with

Table 1. Condition of analysis

Pretreatment	Extract solvent	Sample 1L : Dichloromethane
	Filter and Particle : Toluene (Soxhlet)	
	Extract velocity	5 times/hr
	Number of acid treatment	Sulfur acid 10ml, 3 times
	Concentration	Rotary evaporator
GC Condition	Injection method	Splitless
	Injection volume	1 μ l
	Injector temperature	270 °C
	Carrier gas	Purified helium gas
	Pressure	28 psi
	Column	DB5-MS,60m*0.25mm ID, 0.25 μ m thickness
	Oven condition	150 °C(2min)→215 °C(50 °C/min, 8min)→225 °C(2 °C/min, 8min)→315 °C(7 °C/min, 10min)
MS conditions	MS	Micromass, Autospec Ultima
	Type	Double focusing type
	Resolution	10,000(10% valley)
	Detected method	Selected ion monitoring(SIM)
	Ionization method	Electron impact ionization(EI+)
	Ionization energy	32.0 eV
	Source temperature	270 °C

rotary evaporator at 40 °C, 80mbar. Two extracts were combined and dissolved with 100ml of n-hexane. The n-hexane layer was treated with conc. sulfuric acid (10ml) in a separate funnel and this was repeated several times until the color was removed. After washing with distilled water (100ml) 2times and then drying over anhydrous sodium sulfate, n-hexane layer was evaporated to 1ml by means of rotary evaporator at 40 °C, 400mbar.

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Clean up of these extracts were performed on a silica column and alumina column according to the EPA method 1613. Sample extracts were concentrated to 1ml, and spiked with 10 μ l of ¹³C₁₂-labeled recovery standard at a concentration level of 100pg/ μ l. Then they were concentrated to a final volume of 20 μ l. The purified PCDDs/Fs extracts were analyzed on a Micromass Autospec-Ultima equipped with a CE 8000 series gas chromatograph, operating at 10,000 resolving power in the SIM mode, using a 60m SP 2331 capillary fused silica column(0.25mm id, 0.25 μ m film thickness). Quantitative determination was performed by the relative calibration method using relative response factor previously from standard mixture solution.

Results and Discussion.

The results of experiment are listed in Table 2. In this study, we compared with concentration and composition of PCDDs/Fs in the leachate. The recovery of these compounds in all cases ranged from 45 to 97%. The total concentrations of PCDDs and PCDFs were 493.76pg/l, 103.7pg/l, 57.5pg/l, 398.88pg/l in the site1, 2, 3 and 4, respectively. 2,3,7,8 TCDD, 1,2,3,4,7,8,9 HpCDD and OCDF were not detected in all sites.

The distribution of PCDDs and PCDFs showed considerable differences in the level of

Table 2. Total concentration &TEQ value of PCDDs/Fs in the sampling sites

Compound	Isomers	I-TEF	Site 1		Site 2		site 3		site 4	
			pg/l	PgTEQ/l	pg/l	pgTEQ/l	pg/l	pgTEQ/l	pg/l	pgTEQ/l
PCDFs	2,3,7,8-TCDF	0.1	6.11	0.611	3.27	0.327	3.1	0.31	3.17	0.317
	1,2,3,7,8-PeCDF	0.05	6.24	0.312	6.71	0.336	9.06	0.453	8.18	0.409
	2,3,4,7,8-PeCDF	0.5	8.50	4.25	8.74	4.37	11.14	5.57	10.68	5.34
	1,2,3,4,7,8-HxCDF	0.1	7.93	0.793	7.75	0.775	6.08	0.608	13.72	1.372
	1,2,3,6,7,8-HxCDF	0.1	8.04	0.804	9.87	0.987	10.31	1.031	6.72	0.672
	2,3,4,6,7,8-HxCDF	0.1	8.68	0.868	9.13	0.913	13.15	1.315	10.86	1.086
	1,2,3,7,8,9-HxCDF	0.1	0.58	0.058	4.89	0.489	ND	ND	ND	ND
	1,2,3,4,6,7,8-HpCDF	0.01	17.66	0.177	9.64	0.096	7.73	0.077	11.82	0.118
	1,2,3,4,7,8,9-HpCDF	0.01	ND	ND	ND	ND	ND	ND	ND	ND
	OCDF	0.001	ND	ND	ND	ND	ND	ND	ND	ND
PCDDs	2,3,7,8-TCDD	1.00	ND	ND	ND	ND	ND	ND	ND	ND
	1,2,3,7,8-PeCDD	0.5	3.63	1.815	9.52	4.76	11.42	5.71	4.51	2.255
	1,2,3,4,7,8-HxCDD	0.1	4.28	0.428	ND	ND	5.66	0.566	4.46	0.446
	1,2,3,6,7,8-HxCDD	0.1	9.16	0.916	5.74	0.574	4.64	0.464	4.31	0.431
	1,2,3,7,8,9-HxCDD	0.1	5.62	0.562	6.72	0.672	ND	ND	5.97	0.597
	1,2,3,4,6,7,8-HpCDD	0.01	102.3	1.023	13.62	0.136	1.37	0.014	47.31	0.473
	OCDF	0.001	305.0	0.305	8.15	0.008	13.86	0.014	267.2	0.267
Total			493.76	12.832	103.75	14.443	97.25	16.132	398.88	13.783

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individual congeners(fig 2). In general, the concentrations of PCDDs were higher than those of PCDFs, with PCDDs ranged from 2 times to 4 times high for the majority of congeners.

The OCDD were detected the highest concentration in all sites and biological decomposition in part of sludge disposed is considered as a reason of its high concentration. Levels are expressed in picograms of 2,3,7,8 TCDD toxicity equivalents(TEQ) per liter of sample, calculated on the basis of international toxicity equivalence factors(TEF) of individual congeners.

The TEQ of PCDDs /Fs in site 1, 2, 3 and 4 were 12.832pg TEQ/l, 14.443pg TEQ/l, 16.132pg TEQ/l, 13.783pg TEQ/l in the sites, respectively.

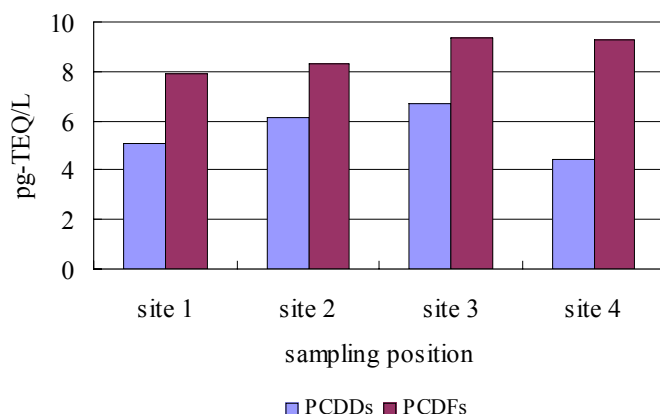


Fig 2. The comparison of TEQ value on PCDDs/Fs in the site

Reference

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