Emission Patterns of PCDDs/PCDFs in Environmental Samples in Korea

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INTRODUCTION

Polychlorinated dibenzo-p-dioxins(PCDDs) and polychlorinated dibenzofurans (PCDFs) are well known to the organic pollutant because of their toxicities and persistent in the environment[1,2]. Recently, the contaminated of PCDDs/PCDFs in environment was very interested to the investigators and common people. Therefore at NIER in Korea, the PCDDs/PCDFs emission levels and patterns were surveyed last few years[3,4] and consistently studied to develope the analytical method in environment.

In this paper, we represented the emission patterns of stack gas(MSWI), wastewater samples, some kind of waste(fly ash) and soil in korea.

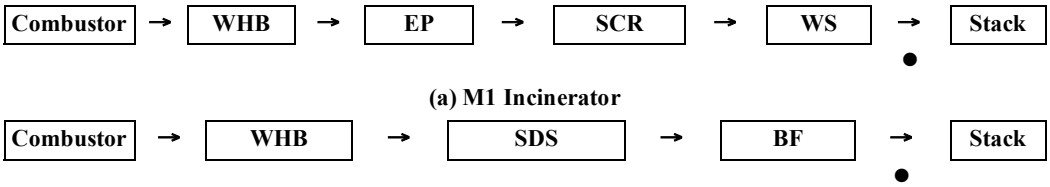
EXPERIMENTAL METHODS

Two kinds of flue gas(M1, M2), three kinds of wastewater(W1, W2, W3, W4), two kinds of fly ash(F1, F2) and three kinds of the soil samples(S1, S2) were analyzed to surveyed the emission pattern in the environmental matrix.

The analytical procedure and condition were performed to the korean official method[6,7]. The HRGC/MS(VG Co., Model Autospec Ultima) was used to analysis the samples and SP-2331 and DB-5MS column were used in the high resolution(10,000).

RESULTS AND DISCUSSION

Emission Patterns of PCDDs/PCDFs in the Flue Gas: The emission patterns of PCDDs and PCDFs in the stack of the MSWI were measured. The sampling point was showed in Figure 1. In M1 and M2 incinerators, the 76% and 61% of total dioxin concentration were made up of the pent-, hexa, and hepta-chlorinated dibenzo-p-dioxin, respectively. The 2,3,7,8-substituted isomers emitted mainly 2,3,4,6,7,8-HxCDF, OCDF, 1,2,3,4,7,8,9-HpCDD and OCDD and 2,3,4,7,8-PeCDF, 2,3,4,6,7,8-HxCDF and 1,2,3,7,8,9-HxCDD in the TEQ as shown in Figure 2.

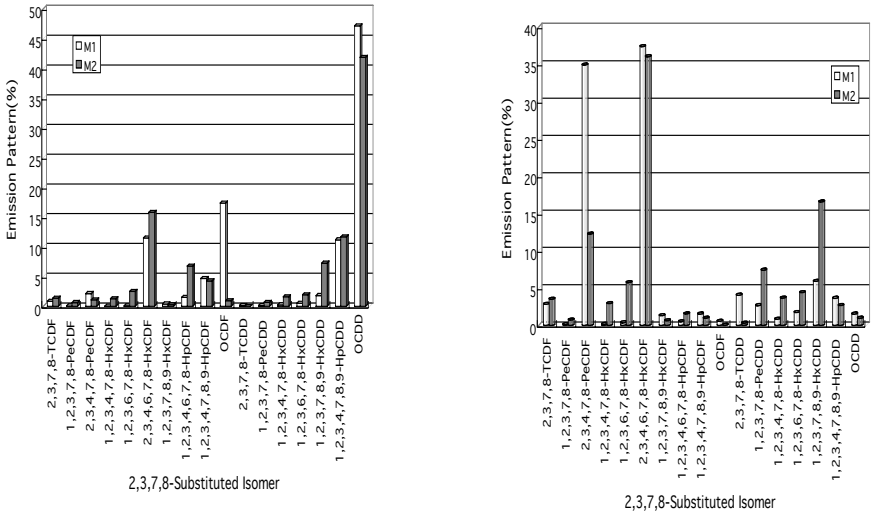


(a) M1 Incinerator

(b) M2 Incinerator

* WHB: Waste Heat boiler, EP: Electrostatic Precipitator
* SCR: Selective Catalytic Reduction, WS: Wet Scrubber
* SDS : Semi-Dried Scrubber, * BF: bag Filter

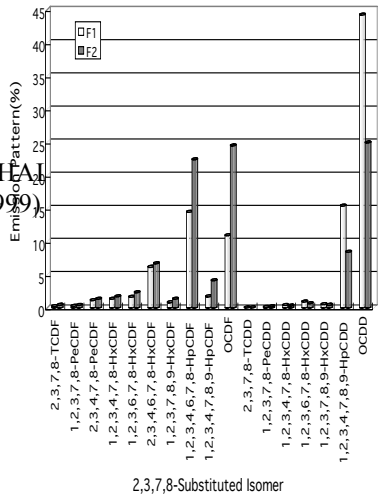
Figure 1. Process Flowchart of Selected Incinerators



(a) 2,3,7,8-Substituted Isomer **(b) TEQ**

Figure 2. Emission Patterns of Flue Gas in MSWI(M1 and M2)

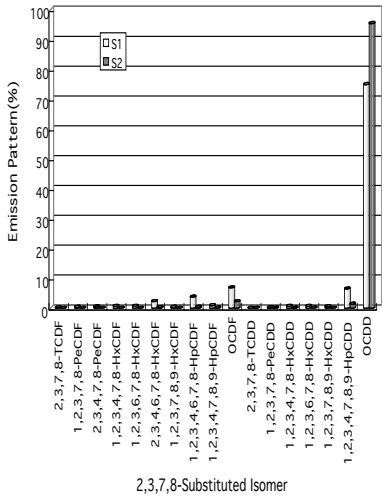
Emission Patterns of PCDDs/PCDFs in the Fly Ash : Two fly ash samples also collected in the M1 and M2 incinerator to survey the emission patterns and observe the relation between flue gas and fly ash. The emission patterns represented in Figure 3. The major emission isomers were similar to the patterns of flue gas, and the levels of the PCDDs/PCDFs were 3.593 ng/g, 0.078 ng-TEQ/g for F1 and 26.502 ng/g, 0.679 ng-TEQ/g for F2.

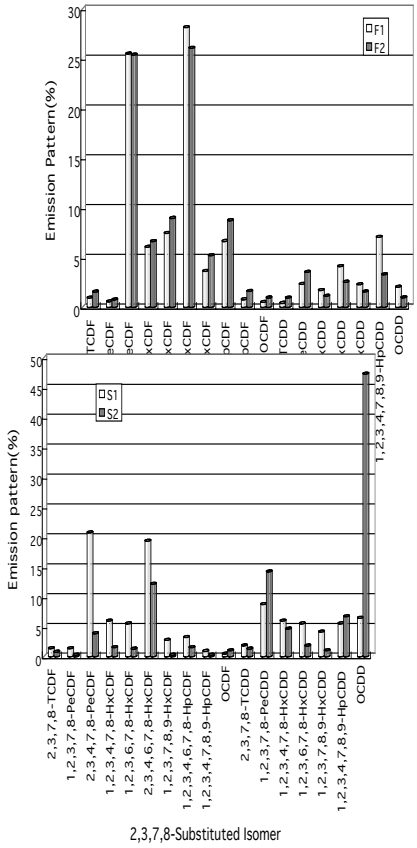


(a) 2,3,7,8-Substituted Isomer

Figure 3. Emission Patterns of Fly Ash in MSWI(F1 and F2)

Emission Patterns of PCDDs/PCDFs in the soil near the M1 incinerator :





(a) 2,3,7,8-Substituted Isomer **(b) TEQ**

Figure 2. Emission Patterns of Soil Samples near the MSWI(S1 and S2)

Two(100m, 1000m) soil samples near the M1 incinerator were collected to survey the relationship to the flue gas. The PCDDs/PCDFs emitted 0.173 ng/g, 0.00076 ng-TEQ/g in S1 and 1.913 ng/g, 0.00321 ng-TEQ/g in S2. The emission of PCDDs was larger than that of furans, and the fraction of OCDD was predominant in soil samples. The emission pattern of M1 flue gas and soil samples represented the negative relation, therefore this result indicate that the flue gas of incinerator could not impact the soil samples. This MSWI has been well operated since 1996 and has many facilities of reducing PCDDs/PCDFs emission.

Emission Patterns of PCDDs/PCDFs in the Waste water: The wastewater also analyzed to observe the emission patterns. The result showed in the Table 1. As show in Table 1, in the case of 2,3,7,8-substituted isomer, the octachlorinated compounds detected to the high levels, but in the TEQ level tetra-, penta- and hexachlorinated ciompounds mainly detected in the suveyed wastewater samples. The 2,3,7,8-TCDD/TCDF was detected in the acid wastewater and 1,2,3,7,8-PeCDD and 1,2,3,4,7,8-HxCDD in the alkali wastewater of the bleaching step. This emitted character corresponded to other country's emission patterns.

Table 1. Emission Patterns in the Wastewater

Matrix	Sample		Emission Pattern	
			2,3,7,8-Substituted Isomer	TEQ
Wastewater	Pulp(W1) (Bleaching)	Acid	· OCDD · 2,3,7,8-TCDF	· 2,3,7,8-TCDD · 2,3,7,8-TCDF
		Alkali	· OCDD · 1,2,3,7,8-PeCDD · 1,2,3,4,7,8-HxCDD	· 1,2,3,7,8-PeCDD · 1,2,3,4,7,8-HxCDD
	Paper(W2)		· OCDD · 1,2,3,4,6,7,8-HpCDD	· 1,2,3,7,8-PeCDD · 2,3,4,7,8-PeCDF
	Dye(W3)		· OCDD · OCDF	· 1,2,3,7,8-PeCDD · 1,2,3,4,7,8-HxCDD
	Leachate(W4)		· 1,2,3,6,7,8-HxCDF · 1,2,3,4,7,8,9-HpCDD · OCDD	· 2,3,4,7,8-PeCDF · 2,3,7,8-TCDD · 2,3,7,8-TCDF

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