THE CHARACTERISTICS OF GAS/SOLID PHASE PCDD/Fs BEHAVIOR IN DUPLICATE BAG FILTER FLUE GAS TREATMENT SYSTEM OF MSWI

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Introduction

In spite of numerous studies, PCDD/Fs behavior in MSWIs is not well established because of complicated factors (waste composition, operating conditions of incinerator and flue gas treatment facility). This study is, therefore, focused on characteristics of PCDD/Fs behavior, of a flue gas treatment system of a full scale MSWI.

As more stringent emission standards are required to incineration gas, gas and solid phase distribution of dioxin/furan should be investigated more throughly, which will eventually be able to give an insight to how to improve gas treatment skills.

A bag filter system equipped with two serial bag sets was utilized to observe the efficiency of this unique system for dust and dioxin compounds, at the same time, PCDD/Fs behaviour between phases was analyzed along with exhaust gas flow line.

Experimental

System Configuration and Sampling Site

The facility is demo plant which treats some parts of flue gas emitted from full scale MSWI boiler outlet. It consists of Spray-Drying Absorber(SDA) for neutralizing acidic gases such as SO_x and HCl, 1st Bag Filter(1st B/F) for filtering Fly Ash, and 2nd Bag Filter(2nd B/F) for removing PCDD/Fs by injecting activated carbon. Flue gas was sampled at SDA Inlet, 1st B/F Outlet, 2nd B/F Outlet(①,②,③) and solids sample was collected at SDA, 1st B/F, 2nd B/F hopper(④,⑤,⑥). So, the facility could be divided into two sections(SDA+1st B/F, 2nd B/F).

The effect of flyash in SDA+1st B/F Section and that of activated carbon in 2nd B/F section was tested and analyzed to see the efficiency of each step and PCDD/Fs behavior both in gas stream and in ashes..

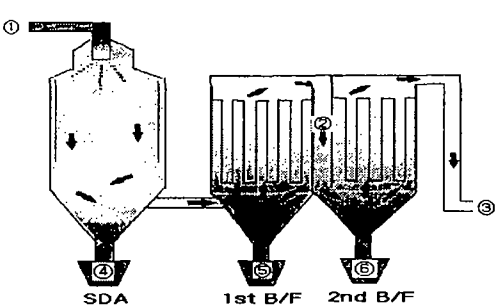


Fig. 1 Schematic Diagram of Test System and The Sampling Location

Sampling, Pretreatment and Analysis of PCDD/Fs

Sample extraction and clean-up were carried out following Standard Method in Korea. The analysis was performed on selected ion monitoring mode with a Micromass Autospec Ultima high resolution mass spectrometer connected with high resolution gas chromatography. In this Study, it was defined that the solid phase means compounds trapped on the filter media and the gas phase means those that through the filter.

Results and Discussion

PCDD/Fs levels

Flue gas sample

PCDD/Fs behavior was investigated through PCDD/Fs mass balance at flue gas treatment facility by separating gas and solid phase PCDD/Fs. In order to compensate the effect of oxygen, all PCDD/Fs concentration was calculated with 12% O_2.

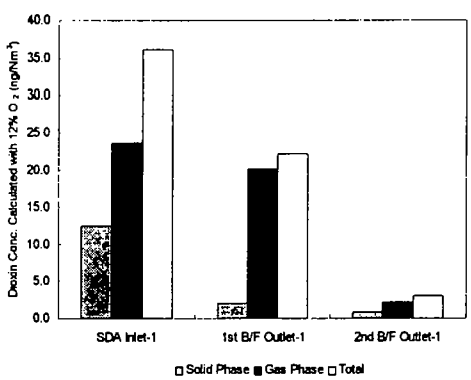
The average PCDD/Fs concentration at SDA Inlet(Boiler Outlet) was 36.034ng/Nm^3, 0.956ng/Nm^3 at 1st B/F outlet and 0.084ng/Nm^3 at 2nd B/F Outlet.

The PCDD/Fs removal efficiency through SDA+1st B/F was about 38% and additional removal efficiency through 2nd B/F was about 53%, indicating that PCDD/Fs were removed in significant amount at the B/F system without injecting activated carbon.

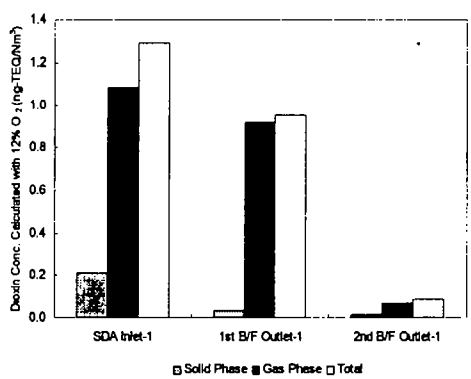
So, it can be said that some PCDD/Fs are removed at B/F without activated carbon, because of the effect by fly ash. Table 1 shows the removal efficiency of PCDD/Fs in the facility and Fig. 2 represents the concentration of PCDD/Fs in each flue gas sample.

Table 1. Removal Efficiency of PCDD/Fs

Phase Distribution	Removal Efficiency (%)			
	Total Conc. Value		TEQ Conc. Value	
	SDA + 1st B/F	2nd B/F	SDA + 1st B/F	2nd B/F
Solid Phase	83.67	93.91	83.41	92.89
Gas Phase	15.06	90.70	14.64	93.61
Total	38.56	91.80	25.89	93.49



(a) Total Concentration Value



(b) TEQ Concentration Value

Fig. 2 The Concentration of PCDD/Fs in Flue Gas for Phase Distribution

Solid sample

Table 2 represents PCDD/Fs concentrations in solid sample at SDA, 1st B/F, 2nd B/F Hopper. Comparing the concentration of fly ash(1st B/F Hopper) with activated carbon(2nd B/F Hopper), the total level was almost same but TEQ concentration was much different. Possible reason is considered as more amount of low chlorinated DD/Fs(higher TEF value) in activated carbon than in fly ash.

Table 2. Concentration of PCDD/Fs in Solid Samples

Main Component	Total Conc. (ng/g)	TEQ Conc. (ng-TEQ/g)
Lime Slurry	3.857	0.078
Fly Ash	52.747	0.741
A / C	49.188	2.621

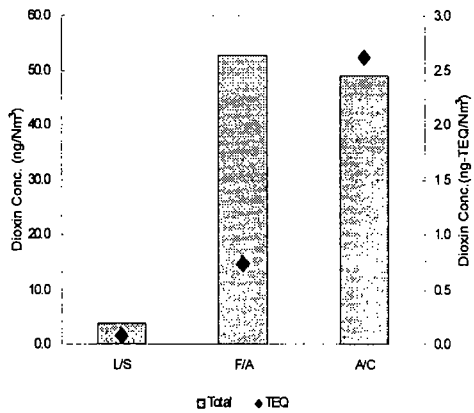
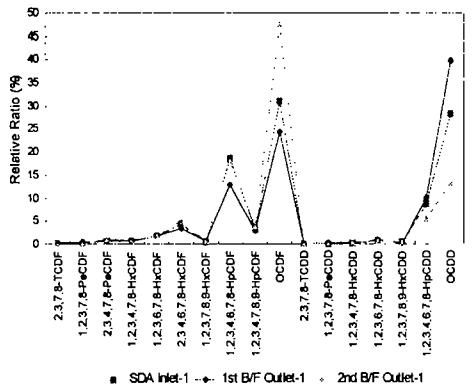


Fig. 3 The Concentration of PCDD/Fs in Solid Samples

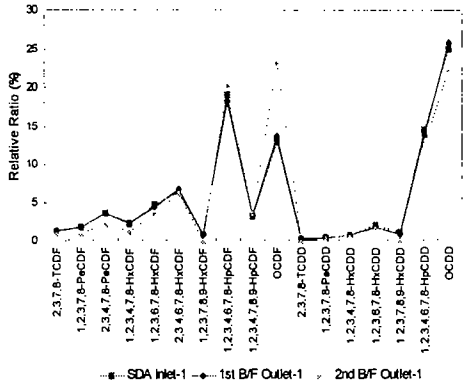
Distribution of PCDD/Fs Isomer

Flue gas sample

In terms of isomer pattern, high chlorinated DD/Fs(Hepta and Octa) concentration was generally higher than low chlorinated(Tetra~Hexa) both in solid and gas phase samples. As the exhauste gas passes through the plant, it shows the tendency that the portion of PCDFs at 2nd B/F increases compared to that of PCDDs. Fig. 4 shows the isomer pattern of each flue gas sample.



(a) Relative Ratio of Isomer in Solid Phase



(b) Relative Ratio of Isomer in Gas Phase

Fig. 4 The Isomer Pattern of PCDD/Fs in Flue Gas

Solid sample

To be different from flue gas sample, PCDDs concentration in solid samples is higher than PCDFs. As the process proceeds PCDDs shows a tendency to decrease.

When it passed through the SDA+B/F system, PCDDs is removed more than PCDFs possibly due to the effect of fly ash and activated carbon.

Fig. 5 shows the isomer pattern of solid samples.

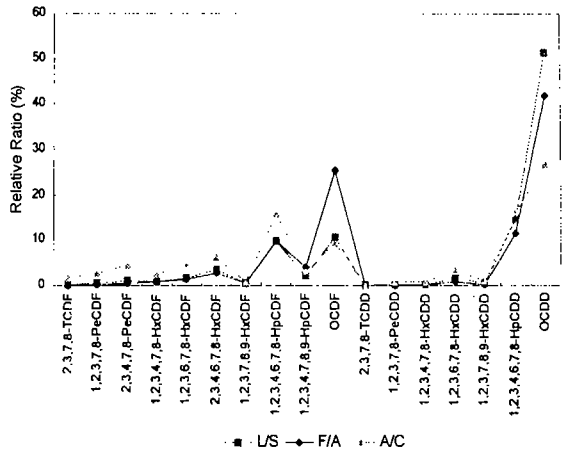


Fig. 5 Relative Ratio in Solid Samples

Conclusions

A bag filter (with dual bags) system both with SDA and activated carbon injection for incinerator emission gas control was selected to study PCDD/Fs removal efficiency and gas/solid phase distribution characteristics.

The SDA and first bag removed significant amount of solid phase dioxins, however, the activated efficiency compared with the first bag system.

PCDDs showed higher tendency to accumulate in solid phase than PCDFs, which exist at higher level in gas stream. stricker mass balance approach is under process to reveal the PCDD/Fs transfer throughout incinerator exhaust gas stream.

References

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