

Behavior of PCDDs, PCDFs and Coplanar PCBs in MSW incinerator

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1. Introduction

There has recently been a great deal of concern about environmental pollution caused by dioxin. In addition, there are reports of coplanar polychlorinated biphenyls (PCBs), being emitted from municipal solid waste incinerator^{1),2),3)}.

This paper reports the results of study about the behavior of PCDDs, PCDFs and coplanar PCBs in a conventional working furnace and an emission controlled furnace.

2. Study Method

We conducted sampling of PCDDs, PCDFs and PCBs at three working municipal solid waste incineration furnaces. The four points at which samples were taken were the furnace outlet, boiler outlet, dust collector outlet and stack inlet. Sampling and analysis of dioxin were conducted according to the "Dioxin Measurement and Analysis Manual for Waste disposal⁴⁾". Sampling of coplanar PCBs was conducted using the same method as for dioxin and analysis was carried out based on the reports^{1),5)}.

3. Result and Discussion

3.1 Dioxin

The results of dioxin measurements taken at a conventional furnace and an emission controlled furnace are shown in table 1. The type of dust collecting equipment for the both furnace is an electrostatic precipitator(EP).

As a countermeasure against dioxin emission in plant B, emphasis was placed on temperature (of among the "3T's"), and was operated while maintaining a furnace flue gas temperature of 900 to 950°C.

The results show that formation at the EP which is considered to be the location of formation can be controlled for conventional furnaces by high temperature combustion. This appears that the precursor concentration of exhaust gas is reduced because of high temperature combustion.

The results of a study about the behavior of dioxin using a "bag filter and selective catalytic reduction (SCR)" system are given in table 2. The results show that, as it has been stated in the past, dioxin emission can be reduced by using a bag filter as dust collecting equipment. The results also show that the lower the bag

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Table 1 Results of dioxin measurements taken for a conventional furnace and an emission controlled furnace. (Unit ng I-TEQ/Nm³)

Plant	Subject	furnace	boiler	EP	Stack
		outlet	outlet	outlet	inlet
A	Conventional	11.43	3.93	11.91	5.08
		13.69	5.13	18.73	7.87
B	Emission controlled	0.19	1.50	0.47	0.39
		0.21	1.00	1.60	0.41

Table 2 Results of dioxin measurements with a "bag filter and selective catalytic reduction" system. (Unit ng I-TEQ/Nm³)

Bag Temp.	SCR Temp.	boiler	BF	SCR	Stack
		outlet	outlet	inlet	inlet
150°C	200°C	4.70	0.33	0.21	0.18
170°C	200°C	8.00	0.38	0.01	0.11
140°C	230°C	1.8	0.08	0.63	0.06
140°C	230°C	1.1	0.06	0.39	0.02

filter's operating temperature, the higher its capacity to remove dioxin is. Concerning the operating temperature of SCR system, the result of this experiment shows that dioxin can't be reliably decomposed at 200°C, however emission of dioxin can be reduced at 230°C.

3.2 Coplanar PCBs

The results of a comparison study of coplanar PCBs concentration with an EP and with a bag filter in a conventional furnace are shown in table 3. The toxic equivalency factors used were the ones proposed by S.Safe et al⁶).

A comparison of tables 1, 2 and 3, the TEQ concentration of coplanar PCBs shows that the TEQ concentration of dioxin is several percentages and was slight in terms of absolute quantity.

In plant using an EP as dust collecting equipment, coplanar PCBs tend to increase inside the just as dioxins do. On the other hand, in plant using bag filter as dust collecting equipment, coplanar PCBs can be reduced. The temperature of the bag filter at this time was among 150 to 170°C, and sampling and analysis of coplanar PCBs was carried out together with the dioxin sampling.

The results showed that it was possible to control the emission of not only dioxin, but also coplanar PCBs by using a bag filter as dust collector equipment.

The results indicate that the removal of coplanar PCBs is, in other words, a shift to the filtrated ash side. We therefore studies the

Table 3 Concentration of coplanar PCBs for each type of dust collecting equipment. (Unit ng TEQ/Nm³)

Dust collector	furnace	boiler	dust collector	SCR	Stack
	outlet	outlet	outlet	inlet	inlet
EP	0.20	0.09	0.51	-	0.33
	0.18	0.09	0.77	-	0.51
Bag filter	-	0.350	0.006	0.002	0.003
	-	0.059	0.004	0.002	0.000
	-	0.26	0.0017	0.0029	0.0015

Table 4 Thermal decomposition characteristics of coplanar PCBs. (Unit ng TEQ/g)

	Heater temperature		
	308°C	365°C	412°C
Raw ash	0.048	0.056	0.057
Treated ash	0.0036	0.00066	0.00052
Decomposition rate	92.5%	98.8%	99.1%

decomposition characteristics of coplanar PCBs with a dioxin thermal decomposition unit. The results obtained through analysis are given in table 4. The concentration of O₂ in the unit during the test was a maximum of 0.6 %, and the residence time of fly ash in the reactor was about one hour. The results show that coplanar PCBs also can be decomposed by a dioxin thermal decomposition unit.

4. Conclusion

The following conclusions were reached as a result of this study.

- (1) Formation of dioxin can be controlled through high temperature combustion.
- (2) Coplanar PCBs are also increased at the EP.
- (3) By using a bag filter, emission of not only dioxin, but coplanar PCBs also could be reduced.
- (4) Coplanar PCBs also can be decomposed in a thermal decomposition unit.

5. References

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