GAS/PARTICLE AND SIZE DISTRIBUTION OF DIOXINS IN AMBIENT AIR

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Introduction

There are many kinds of hazardous pollutants in the environmental air, some of these shows mutagenic and carcinogenic activities. Human health is influenced by long term exposure of these kind of compounds. Dioxins are also suspected one of these kind of compounds with other types of toxicity. They are widespread in environment and are closed to our life. It is considered that municipal solid waste incinerators are main sources of Dioxins, recently in Japan. They are often emitted these into the atmosphere as condensed species absorbed on fine fly ash particle. The particles in inhaled air are deposited on different part of respiratory tracts depend on particle size, etc. And some kinds of Dioxins exist on the particles and/or gas phase.

In this study, Dioxins in ambient air were collected with filter and PUF using high volume air sampler. And 12 size of particulate samples were also collected using Andersen sampler with low pressure impactor. We compared gas/particle and size distribution of Dioxins in ambient air to understand the human exposure conditions.

Experimental

Sample collection

Ambient air samples were collected for 24hrs in Chiba at December by high volume air sampler (Kimoto Co.). Particulate and gaseous Dioxins were collected both on filter and in polyurethane form (PUF), and particles on filter were measured.

The size distribution samples were collected at Tokyo in February using two set of Andersen samplers equipped with low pressure impactor (Tokyo Dylec Co.). These samplers can be used to classify particles in environmental air into 13 groups according to particle size ranged from less than 0.13um to over than 12.1um and gas component.

Analysis

Each sample (filter and PUF) was extracted with toluene using Soxhlet extractor for 16 hrs. After extraction, internal standards were spiked in each sample, and purified by JIS K-0311 method. Dioxins (PCDDs, PCDFs and CoPCBs) were determined by HRGC-HRMS (JEOL).

Results and Discussions

Dioxins in ambient air are usually collected by filter and PUF in Japan[1]. Filter and PUF samples were analyzed firstly to determine the ratio of particle/total dioxins. The results were shown in table 1. In all samples, TeCDDs/Fs in particle were lower ratio than other congeners. It was shown that most dioxis were collected on filter as particle dioxins in winter.

Table-1 The ratio of particle/total dioxins

(unit:%

		Sample-1	Sample-2	Sample-3	Sample-4	Sample-5	Average
PCDF	TeCDFs	68	35	63	45	48	52
	PeCDFs	100	79	96	98	96	94
	HxCDFs	100	98	100	100	100	100
	HpCDFs	100	94	100	100	100	99
	OCDF	100	100	100	100	100	100
	Total PCDFs	94	75	88	85	86	86
PCDD	TeCDDs	73	33	71	48	52	55
	PeCDDs	100	93	100	100	99	98
	HxCDDs	100	100	100	100	100	100
	HpCDDs	100	96	100	100	100	99
	OCDD	100	100	100	100	100	100
	Total PCDDs	96	87	96	92	93	93

The deposit of particles in human respiratory tracts depend on the particle size, etc[2]. Sampling for size distribution were carried out for a week continuously at Tokyo in February using two set of Andersen samplers equipped with low pressure impactor. This result was shown in Figure 1. Because dioxins concentrations in ambient air were very low, all isomers and congeners could not be detected. But, two peaks were confirmed at 0.52um and <0.13um of particle diameters. Size distribution patterns of this results was simulated with PAH[3] and recent study[4]. Only TeCDDs/Fs were detected from PUF as similar result from the high volume air sample. And Dioxins were very low levels over 2.5um diameter. The Dioxin inventory shows that the main source of Dioxins is the combustion of municipal waste in Japan. Particle in stack gas from municipal solid waste incinerator are able to be source of dioxins and particles in ambient air. But, in this study, because

dioxins concentrations were very low, we could not confirmed that accurate concentrations of dioxins in particle.

We are collecting the size distribution samples, and increase total sampling volume for dioxins to analysis accurate dioxins concentration. And we are going to re-analyze recent samples.

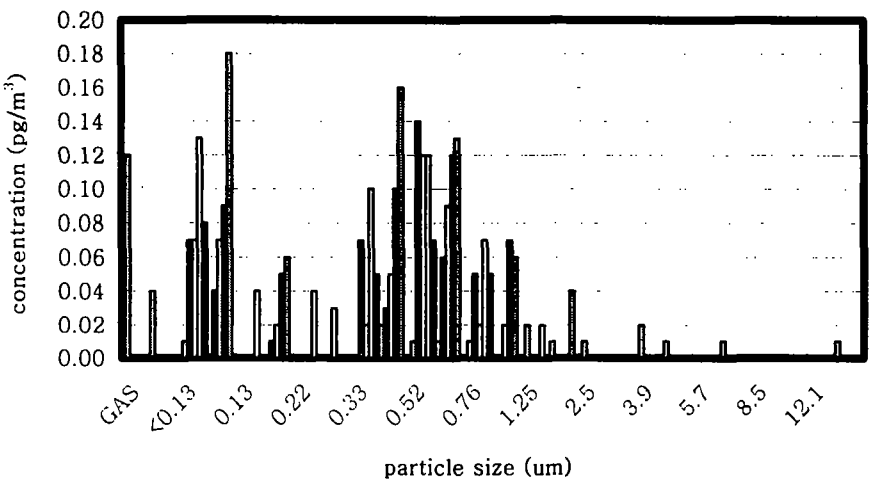

Fig.1 Size distribution of PCDD/F in urban airborne particule

References

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