NEW SAMPLING FILTER FOR PCDDs/PCDFs AND Co-PCBs IN EXHAUST GAS FROM INCINERATORS

Osamu Kajikawa[1], Katsuhisa Honda[2] and Takatomo Fujii[3]
[1] R&D Department, Osaka Gas Co., LTD, 6-19-9, Torishima, Konohana, Osaka 554-0051, Japan
[2] Miura Institute of Environmental Science, Miura Co., LTD. 284-1 Tsuji, Hojo, Ehime 799-2430, Japan
[3] Taiyo-Kasei Co., LTD 3-8-21 Jyo-nan, Ikeda, Osaka 563-0025, Japan

1. Introduction

The impinger method conventionally used for sampling exhaust gas has several disadvantages, including contamination from glass apparatus, complicated on-sight settings, and damage to impingers during transport. Miura and Osaka Gas developed a filter for dioxin sampling to overcome these problems and have reported on the efficacy of this sampling filter. The Laws Concerning Special Measures against Dioxins in Japan were enacted for dioxins, however, measurement is required not only for PCDD's/PCDF's, but for Co-PCB's as well. This paper describes the development of a filter capable of sampling both PCDD's/PCDF's and Co-PCB's, and its absorption characteristics. Furthermore, the sampling method used with this new filter and results of an experiment comparing this method to the conventional using stack gas samples will also be presented.

2. Methods and Materials

2.1 Sampling Filter Specifications

Table 1. Specifications for the newly developed PCDD's/PCDF's/Co-PCB sampling filter

Main Material	Alumina fiber
Weight/g	10
Dimensions/mm	18.8x110L
Pressure loss/kpa(mmH_2O)	<2.0(200)
Initial contents of dioxin and Co-PCB content/ng-TEQ	<0.0028

2.2 Dioxin and Co-PCB Adsorption Characteristics of the New Sampling Filter

Exhaust gas from incinerators with different levels of combustion efficiency was sampled in order to determine dioxin and co-PCB tolerances of the sampling filter. As shown in Fig. 1., an impinger was also installed past the sampling filter in order to determine if there was leakage. For comparison, the same test was conducted using the conventional type sampling filter made of carbon fiber.

3. Results and Discussion

3.1 Recovery Test of New Sampling Filter

An experiment to test recoveries of the sampling filter using effluent extracted from exhaust gas samples (hexane solution). The fluid was added to the top of the sampling filter and extracted with toluene using high-speed Accelerated Solvent Extractor (ASE-200 by DIONEX). The extract was refined before it was analyzed by high-resolution GC-MS spectroscopy

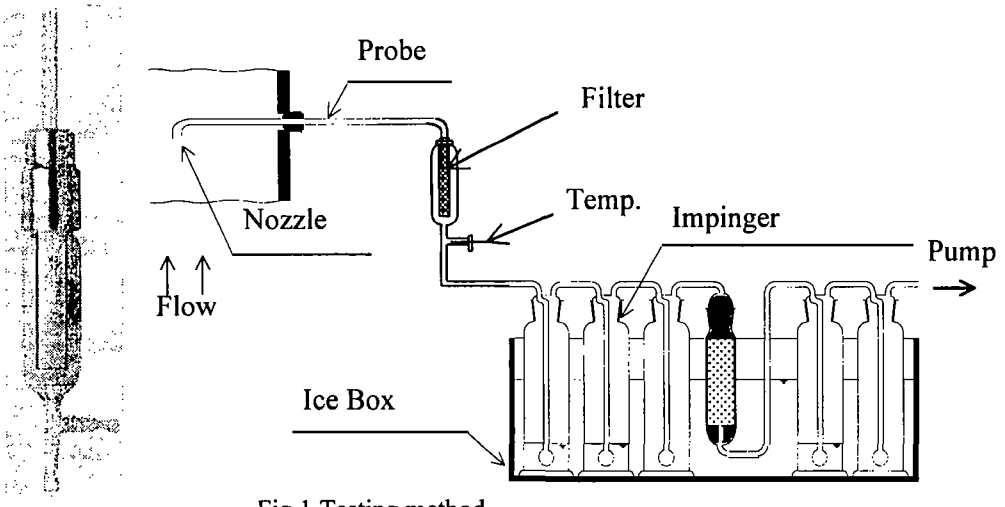

Fig.1 Testing method

The recovery rate was good in both cases at 94 to 105% (90~99%) in the concentration range of 70 to 7,000ng (1.3 to 130ng-TEQ) for dioxins, and 92 to 98% (93 to 97%) in the range of 1 to 100 ng (0.01 to 1 ng-TEQ) for Co-PCBs.

3.2 Comparison of the Conventional Impinger Method to the New Sampling Filter

Incinerator exhaust gas with dust density of 10 to 100 mg/m^{3}N was simultaneously sampled by conventional means at an intake flow-rate of 20 L/min. The sampling filter sample was extracted using a high-speed Accelerated Solvent Extractor and the conventional method employed Soxhlet extraction. After normal clean up, dioxin and Co-PCB concentration in the exhaust gas was measured by high-resolution GC-MS spectroscopy. The results obtained from the sampling filter extracts agreed well with the values from conventional means as shown in Figs. 2 & 3.

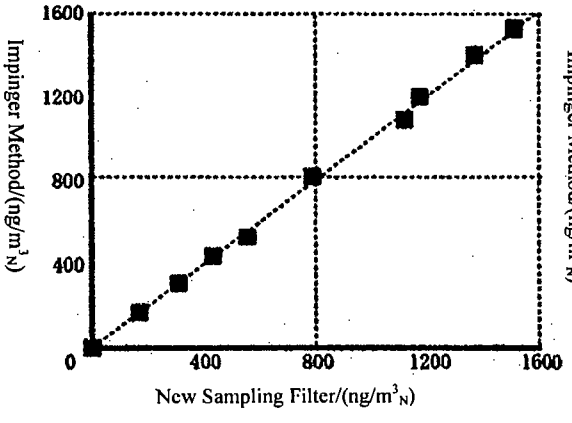

Fig.2 Concentration of PCDDs/PCDFs

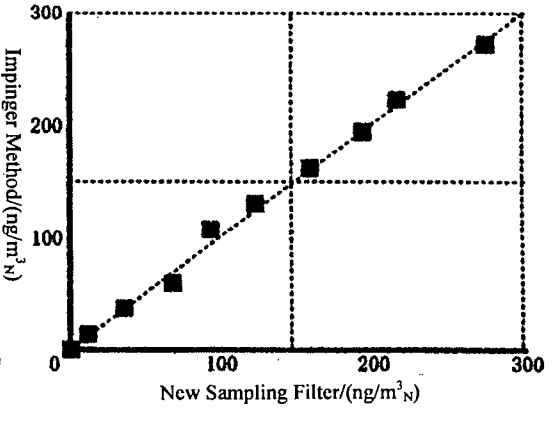

Fig.3 Concentration of Co-PCB

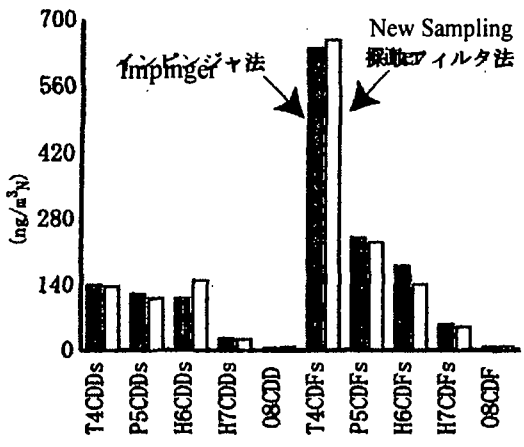

Fig.4 PCDDs/PCDFs

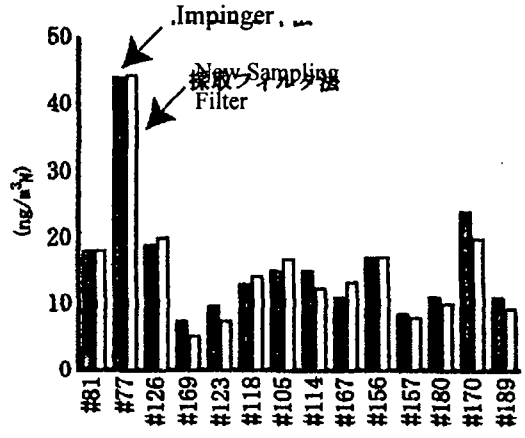

Fig.5 Co-PCBs

The results of comparisons with homologues and isomers were nearly identical as well, as shown in Figs. 4 & 5. This is possibly because they are non-degrading and non-generating.

4. Conclusion

The preceding results confirm the new sampling filter made of alumina fiber adsorbs dioxins and Co-PCBs from less than 2.5 mg of tar in incinerator exhaust gas and that it performed as well as the conventional impinger method.

Reference

1.F.Nakamura, et.al., the 8th Japanese Conference on Environmental Chemistry, p.62, Kita-kyusyu, 1999