ANNUAL VARIATION AND BEHAVIOR OF PCDDs/DFs IN AMBIENT AIR, KOREA

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Introduction

Polychlorinated-*p*-dioxins (PCDDs) and polychlorinatedfurans (PCDFs) are widely distributed as environmental pollutants and their sources are various. Sources of PCDDs/DFs included artificial sources such as municipal waste incinerators (MWIs), the petrochemistry product, wastewater of agricultural chemical relation industry and the chlorine bleaching process of restraint industry [1] and also natural sources such as fire and volcano explosion. Many researches related to the exhaust control countermeasure appropriable for the reduction of PCDDs/DFs have been performed in advanced nations [2].

It is consisted that PCDDs/DFs accumulate in environment medium such as air, water, sediment, soil and finally in human body through the food chain [3-10]. PCDDs/DFs exist as gas or particle phase at infinitesimal quantity in atmosphere and have continuous accumulation characteristic into human body. Also, because their disappearance or excretion from environment or in the body is very slight, researches have been often performed for the concentration of PCDDs/DFs in atmosphere with respect to human risk assessment [11].

Environmental samples contain various and complicated chemical compounds and the reliability for pretreatment method of PCDDs/DFs are strongly demanded. However, the study for qualification analysis in an infinitesimal concentration level has been far behind other environmental studies.

In Korea, the study for their concentration analysis related to a gas phase carrying out from the MWIs is being advanced, but the study in environmental atmosphere is very rare.

This study was carried out investigation of the concentration level, distribution characteristics and behaviors for PCDDs/DFs in ambient air, Korea.

Materials and methods

The study was performed on the rooftop of the 4th building at Pukyoung National University in Busan which is anticipated the effect of stationary source and mobile source such as automobile, during about one year (March 1999 - April 2000). Sampling location in this study is shown in Figure 1.

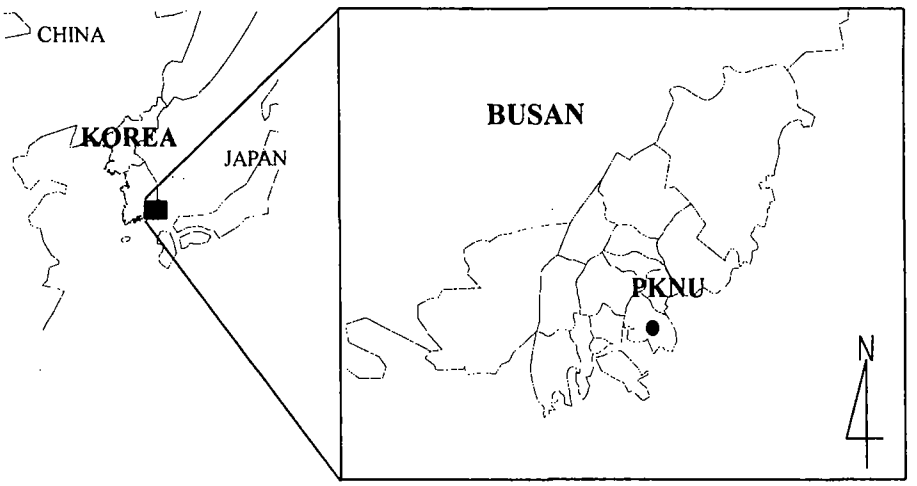

Figure 1. Sampling location in this study.

High Volume Air Sampler (PUF type) was used to collect particle phase and gas phase in atmosphere.

Collected glass fiber filter (GFF) and poly urethane form (PUF) were extracted with a reflux extraction (with toluene 200ml for 6 hour) and soxhlet extraction method (with acetone 300ml for 18 hour), respectively and then concentrated to 10ml. Extracts were converted with solvent to *N*-Hexane, adding the internal standard (CIL inc., EDF-8999). Samples were purified using a multi-layer silica gel column chromatography and an alumina column chromatography, and the last concentration volume was adjusted to 50$\mu\ell$ [6,12].

PCDDs/DFs compounds were analyzed by the HRGC/HRMS-SIM mode (HP 6890 series II GC / JMS-700 MS). Analytical detail methods and conditions were referred from Ok et al. (2000). The TEQ concentrations for PCDDs and PCDFs were calculated using 2,3,7,8-TCDD international toxic equivalency factors (I-TEFs).

Results and Discussion

Concentration level

Results for samples analysis were shown in Figure 2 and Figure 3. Concentration range for all samples was 1.077 ~ 24.273 pg/m^3 (0.015-0.274 pg-TEQ/m^3) and showed widely. Figure 2 showed monthly average concentration level for samples. In monthly total concentration level, the highest concentration of PCDDs/DFs was measured in January (1.077 pg/m^3), and the lowest concentration in August (24.273 pg/m^3). The total concentrations appeared a positive monthly variation in all samples. In summer, relatively a low concentration level was detected, suggesting that PCDDs/DFs adhered to suspended particles in atmosphere and deposited into the earth' s surface during rainy season. And it is also considered that the concentration level in January was due to the fossil combustion process such as home heating and mobile source in cold winter season. The monthly variation of I-TEQ concentration was also similar to that of total concentration.

Distribution of gas and particle phase

The monthly distribution of gas and particle phase showed in figure 3 appeared highly the gas phase concentration by high temperature in summer. In winter, due to increase of combustion activity and low temperature, the distribution of the particle phase concentration appeared higher than that in summer season. Is spite of high temperature in summer season, the distribution of particle phase concentration in August was lower than expected and it might be due to precipitation in rainy season. Then, according to decrease of temperature, gas phase concentration decreased gradually. Distribution of gas and particle phase appeared also monthly variation in total and I-TEQ concentration.

Results suggest that the concentration of PCDDs/DFs in atmosphere was influenced positively by temperature, rainfall and fossil combustion process such as home heating and mobile.

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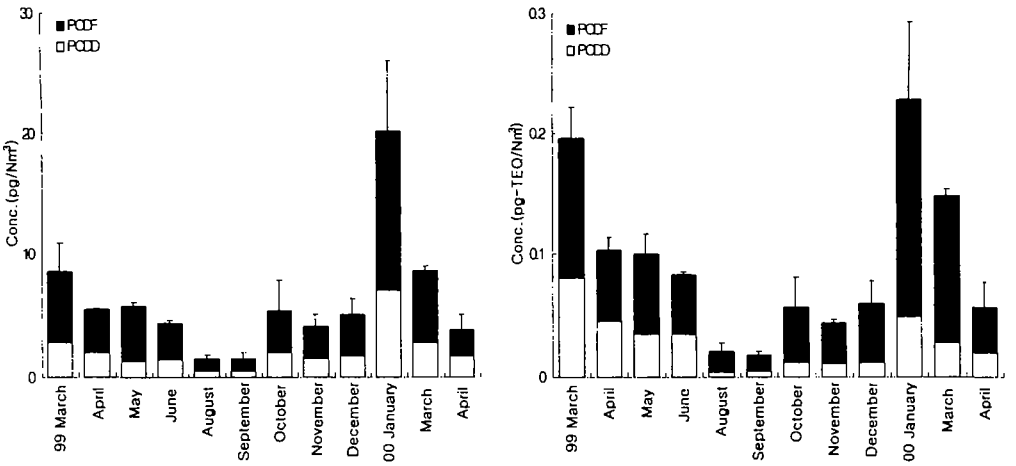

Figure 2. Total (left) and I-TEQ concentration (right) for monthly average.

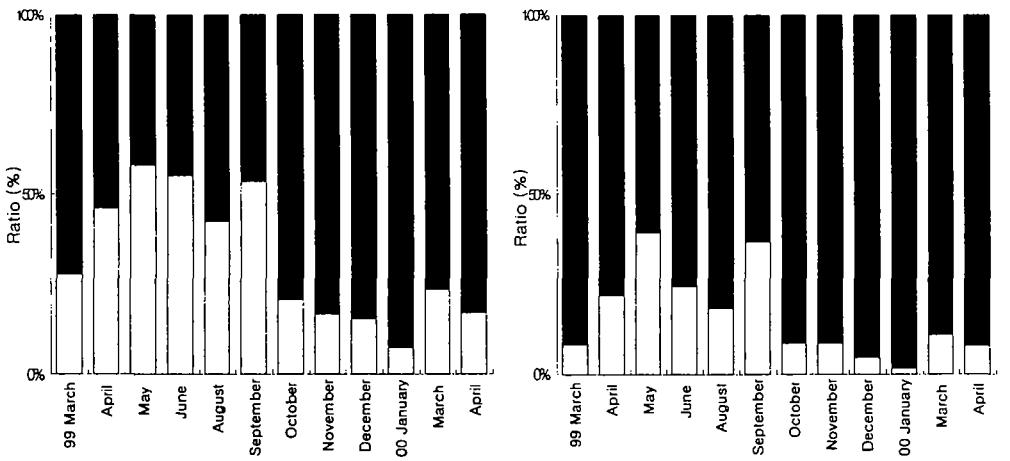

Figure 3. Vapor(□)/particulate(■) distribution total (left) and I-TEQ concentration (right) for monthly average.