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THE SURVEY OF THE LEVEL OF PCDD/FS IN AMBIENT AIR IN KOREA BETWEEN 1999 AND 2002

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1. Introduction

Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) are toxic compounds produced unintentionally from by-products of chlorine chemistry, municipal waste incineration and several kinds of industrial activities[1,2,3]. These toxic compounds are ubiquitously found out in environment [4,5,6]. The levels of PCDD/Fs concentration in ambient air in other countries have been surveyed. In Germany, 1993, the level of PCDD/Fs in rural ranged from 0.025 to 0.070 pg TEQ/Nm^3 and the level in urban ranged from 0.070 to 0.350 pg TEQ/Nm^3 [7]. In Japan, the level in large cities ranged from 0.0005 to 1.1 pg TEQ/Nm^3 and the level in small/medium cities ranged from 0 to 0.86 pg TEQ/Nm^3 [8].

Fortunately, latest data concerning the concentration of PCDD/Fs in ambient air have shown a trend of decreasing level in many areas [6, 9].

However, in Korea, data concerning the decrease of PCDD/Fs in ambient air have not been reported. Therefore, in this study, we have investigated variation of the level of PCDD/Fs in ambient air during fall time over four year periods, between 1999 and 2002

2. Methods

2.1 Sampling sites

In this study, 18 sampling sites were classified into 4 classes: residential area (n=8), commercial area (n=3), industrial area (n=3), and roadside area (n=4). And one sample was collected as a background sample. Sampling was performed 4 times during fall times between 1999 and 2002.

2.2 Sampling collection.

All samples were collected by according to TO-9 (USEPA method) with high volume samplers (Sibata HV-1000F). The sampling module held a Whatman Quartz Fiber filter followed by two polyurethane foam (PUF) plugs. Prior to using Quartz Fiber and PUF, the Quartz Fiber was pre-cleaned by baking them at 600 for 5hrs and the PUF plugs were pre-cleaned by soxhlet extraction with acetone for 24hrs. All samples were taken for 24hrs giving volumes about 1000 m^3.

After sampling, all Quartz Fibers and PUF plugs were wrapped by aluminum foil in order to avoid degradation of PCDD/Fs due to sunlight. And they were reserved at below zero in a refrigerator until analyzed.

2.3 Analysis

After sampling, Quartz Fiber and PUF were extracted with toluene using soxhlet apparatus for over 24hrs. Prior to soxhlet extraction and cleanup process, all samples were spiked $^{13}C_{12}$-labelled standards. Concentrated extracts were purified by sulfuric treatment, acidic/basic silicagel column,

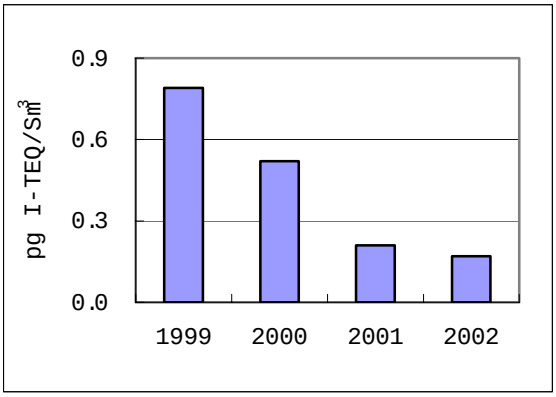
alumina column and activated carbon column. The purified extracts were concentrated to final volume of approximately 40 prior to analysis. TDL (Target Detection Limit) was 0.01 pg/ Nm^3 for 4 5 chlorinated PCDD/Fs , 0.02 pg/ Nm^3 for 6 7 chlorinated PCDD/Fs, and 0.05 pg/ Nm^3 for 8 chlorinated PCDD/Fs

The analysis of samples was performed on the HRGC/HRMS (Autospec Ultima, Micromass Co., UK) using SP2331 column. The following analytical conditions of HRGC/HRMS were used : Splitless injection, injection temperature, 260 : hold 1min , heated to 200 at 10 /min , hold 2min, and then to 260 at 3 /min with a 20min hold. Mass spectrometer was operated with the electron impact source, trap current 500uA, mass resolution > 10,000. Selected ion monitoring was used to further enhanced sensitivity. TEQ values were calculated by applying the common used I-TEF [10].

3. Result and discussion

As shown in Figure 1, the mean I-TEQ concentrations of PCDD/Fs in fall were 0.786, 0.518, 0.206, and 0.165 pg I-TEQ/Sm^3, orderly, for 4 years, from 1999 to 2002. The result showed a downward trend during four year periods. The level of PCDD/Fs in ambient air in fall of 2002 showed a decrease of about 80% compared with that in fall of 1999. The mean level of background was 0.009 pg I-TEQ/Sm^3.

Figure 1. The mean level of PCDD/Fs in all samples



The levels of each class are shown in Figure 2. In the case of the residential area (n=8), the level were 0.29, 0.51, 0.18 and 0.19 pg I-TEQ/Sm^3, orderly, for 4 years, between 1999 and 2002. The level in 2000 was about two times higher than that in 1999, but the levels in both 2001 and 2002, a little more or less than 0.2 pg I-TEQ/Sm^3 , were approximately 30% lower than that in 1999. In the case of industrial area (n=3), the levels were 2.9, 0.35, 0.39 and 0.2 pg I-TEQ/Sm^3. The level in 2002 was about 10 times lower than that in 1999, meaning that variation of level in industrial area was larger compared with other classes. In the commercial area, the level decreased from 0.56, to 0.67, to 0.15 and to 0.08 pg I-TEQ/Sm^3. In that case, the variation of level of PCDD/Fs was also shown to be relatively large : the level in 2002 decreased to about 85% of the level in 1999

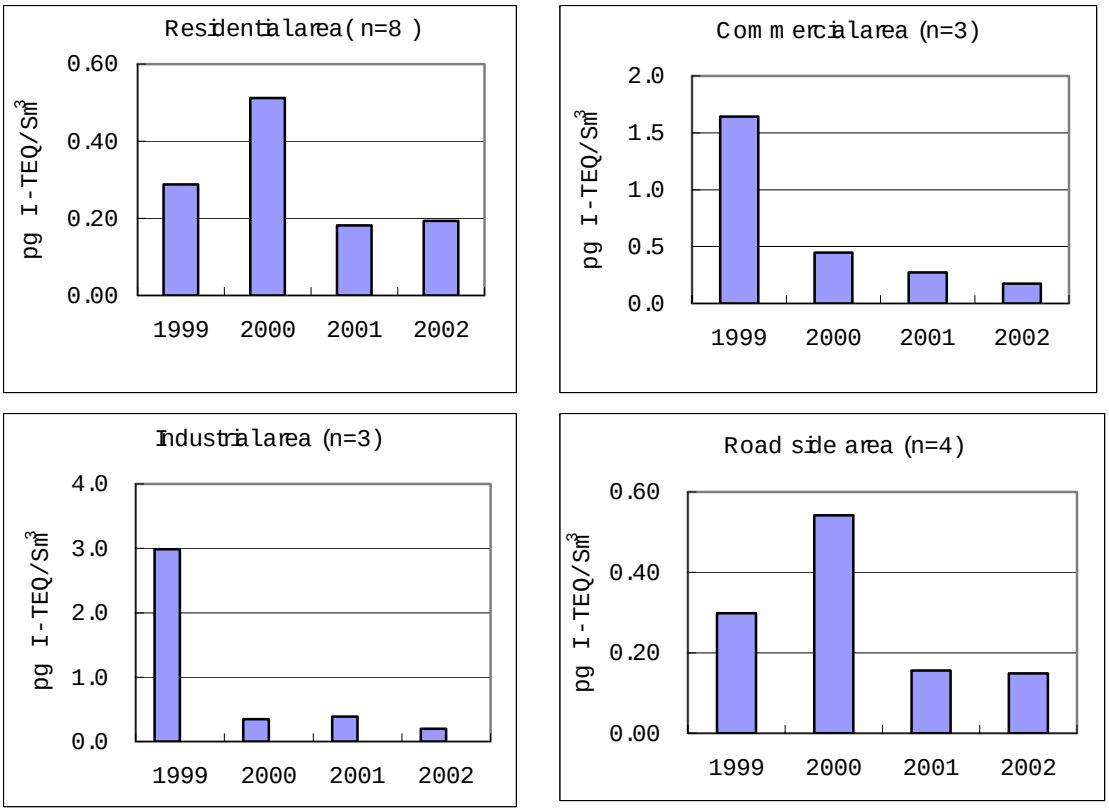
In the roadside area (n=4), the levels were 0.30, 0.54, 0.16, and 0.15 pg I-TEQ/Sm^3 . These values were similar to those in residential area. Like the level in the residential area, the level in 2000 was highest among other levels, but the levels in both 2001 and 2002 were about 0.15 pg I-TEQ/Nm^3 which was lower than that in 1999 by about 50%

Interestingly, in the case of both residential areas and roadsides, since 2000, there was a little

variation of level compared with other two classes.

Consequently, the mean level of PCDD/Fs in ambient air in Korea was generally decreased. The mean level of PCDD/Fs in 2002 decreased to about 80% of the level in 1999. Specially, the levels of PCDD/Fs in industrial and commercial area showed a largely decreased trend compared with other classes. From the result, these classes has a large effect on the decrease of level in PCDD/Fs concentration in Korea

Figure 2. The level of PCDD/Fs in each class



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