Concentration Levels and Distribution Characteristics of PCDDs/DFs in Soil from Pusan area, Korea

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Introduction

Many researchers were investigated concentration of PCDDs/DFs in soil.[1-2] Soil is known as the last deposit site of pollutants emitted into atmosphere and an important environmental media which can grasp present contamination level. In order to observe concentration levels and distribution characteristics of PCDDs/DFs for Pusan area which exists a various sources, soil samples were collected at 24 sites in May 1997 and 1998. Collected Soils were classified as stationary, mobile, park, rural and golf course in accordance with a potential source.

Experimental Methods

Sampling points of soil samples were illustrated in Fig. 1.

Fig. 1. Map showing sampling sites.

Soil samples were taken within a depth of 5cm and dried at room temperature then pulverized into small pieces using 250㎛strainer. Each powdered sample(20g) was extracted with 150ml of toluene for 6 hours under reflux and then filtered. After addition of keeping solvent(n-Nonane 0.5ml), the extract was transferred to n-Hexane and then adjusted to a volume of 10ml. After spiking of internal standards(EDF-8999, CIL Inc.), purified using multi-layer silica gel chromatography and alumina column(Neutral, Activate I, Merck) chromatography and analyzed with HRGC(HP5970)/HRMS(JMS 700, Jeol). Analytical methods and conditions were similar with several papers described previously.[3-4]

Results and Discussion

Concentration levels

Table 1 shows concentration levels of PCDDs/DFs in soil at Pusan area, Korea.

Table 1. The total and I-TEQ concentration levels of PCDDs/PCDFs in soil.

Source types & sites	Total concentration(pg/g)			I-TEQ concentration(pg/g)		
	PCDDs	PCDFs	Sum	PCDDs	PCDFs	Sum
Stationary source						
A	324.75	481.98	806.73	14.97	10.75	25.72
B	992.13	1700	2692.13	27.36	36.94	64.3
C	3288.25	1320.56	4610.81	10.06	11.94	21.99
D	814.5	346.12	1162.62	2.76	2.78	5.54
E	280.39	58.39	338.78	0.88	0.46	1.34
Mobile source						
F	446.08	614.01	1060.09	7.23	11.06	18.29
G	233.3	464.68	697.98	11.15	10.12	21.27
H	244.09	156.03	400.12	9.27	3.17	12.44
I	187.7	84.84	272.54	5.24	2.58	7.82
J	103.83	149.22	253.05	2.43	3.82	6.25
Park site						
K	65.13	96.35	161.48	2.6	3.99	6.58
L	2492.19	758.56	3250.75	11.48	13.68	25.15
M	122.04	137.93	259.97	3.23	3.0	6.23
N	79.41	53.3	132.71	1.6	0.96	2.57
O	105.04	168.78	273.82	1.92	2.55	4.47
P	134.51	79.59	214.1	2.4	1.48	3.88
Rural site						
Q	248.84	92.84	341.68	3.0	0.72	3.72
R	127.59	100.21	227.8	3.32	2.83	6.14
S	127.46	175.26	302.72	2.08	3.08	5.16
T	38.99	22.07	61.06	0.54	0.26	0.8
U	33.77	41.91	76.68	0.55	0.48	1.03
V	5655.06	1055.5	6712.56	14.21	6.33	20.54
W	539.64	271.79	811.43	8.55	5.21	13.76
Golf course						
X	170925	2165.94	173090.94	314.46	8.69	323.16

Concentration levels of PCDDs/DFs at Stationary source represented 1921.41pg/g for mean total concentration and 23.78pg/g for mean I-TEQ concentration. Mean total concentration was 536.75pg/g and 13.21pg/g for I-TEQ at Mobile source. Mean total concentration was 751.47pg/g and 8.14pg/g for I-TEQ concentration at Park site, 1218.71pg/g and 7.31pg/g for mean total and I-TEQ concentration at Rural site, respectively. Total concentration of PCDDs/DFs in soil collected at Golf course represented 173.09ng/g and I-TEQ concentration was 323.26pg/g. The levels by total PCDDs/DFs concentration was the order of Golf course>Stationary >Rural>Park>Mobile, and Golf course>Stationary>Mobile>Park>Rural for I-TEQ concentration. Therefore, the degree of soil pollution of Pusan area by total PCDDs/DFs concentration showed that Golf course considered a pentachlorophenol as the main origin was larger than Stationary and Park site. This finding suggests that contamination by PCDDs/DFs at Golf course are very serious as an aspect of risk assessment. I-TEQ concentration was also the highest at Golf course, and was the concentration order of Stationary>Mobile>Park>Rural in the next. This indicates that the origin of pesticide and combustion highly contributed to concentration of PCDDs/DFs at Pusasn area. Mean total concentration of PCDDs/DFs in soil at Pusan area excluding Golf course was 1104.84pg/g, 13.11pg/g for I-TEQ concentration.

Congener profile

The congener profile of total and I-TEQ concentration for each site presents in Fig. 2. As illustrated in Fig. 2, the same source had a similar congener pattern. Especially A and B site, C and D site, which located at primary wind direction of Stationary source, had the same profile. E site where influenced by Mobile source and K, P site located at Park was a similar pattern. Therefore these results showed a very high contribution by mobile source at this site because Park is located in urban area. O, W site classified Rural area relatively showed a different distribution in accordance with each site, because speical sources do not exist. Especially, congener profile of PCDDs/DFs in X site collected at Golf course showed that OCDD occupied over 90% for total and I-TEQ concentration. This considers an effect of pentachlorophenol used as pesticides in Golf course.[5]

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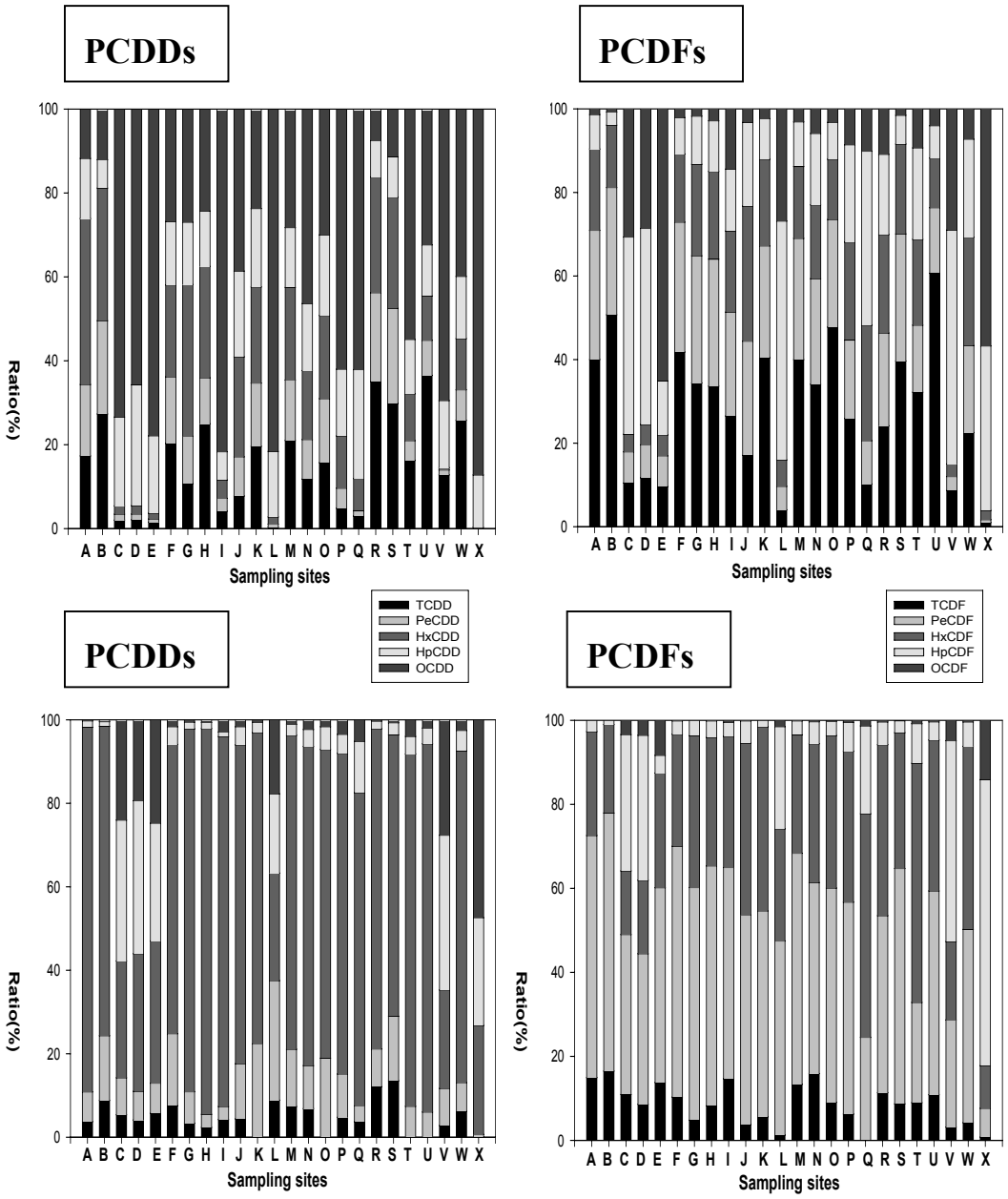

Fig. 2. Congener profile of total concentration and I-TEQ of PCDDs/DFs for each site. Upper two graphs is for total concentration and lower two graphs is for I-TEQ concentration.