

ENVIRONMENTAL LEVELS II --POSTER

THE CONCENTRATION DISTRIBUTIONS OF PCDDs & PCDFs IN SOILS OF AREA CONTAMINATED FROM A SPECIFIC SOURCE

Min-kyun Kim, Byoung-Eog Kim, Hyun-Koo Kim,
Young-Sik Seoung, Kyung-Tae Kim and Jong-Wan Lim¹

Environment & Energy Research Center, Research Institute of Industrial Science & Technology,
P.O. BOX 135, Pohang, Korea

¹Department of Chemistry, Kyung-Pook National University, Taegu 702-701, Kyung-buk, Korea

Introduction

Recently in Korea, dioxins level contained in environment have been investigated. The investigation on concentration of PCDDs and PCDFs contained in soil is very important because it dedicates pollution degree of specific area for a long time. Soils have accumulated dioxins by wet and dry deposition of gas and solid phase. Also soil is important source because the contaminated soils are re-dispersed to air. In this study, we have investigated concentrations of dioxins contained in soils to evaluate dispersion of dioxins from specific main source. In this soil monitoring study, samples of five points were collected.

Materials and Methods

Chemicals

¹³C-labeled PCDDs and PCDFs compounds were purchased from Cambridge Isotope Laboratories, MA, USA. Silica gel(100-200mesh) and Aluminum oxide(-150mesh) were purchased from Alltech, IL, USA and Aldrich, WI, USA. All solvents were purified by reflux.

Samples and MSWI

Soils were collected in 5 points around MSWI. The sampling points were in Figure 1. The collected samples were stored in clean jar. A targeted source discharge gas of about 1,500,000Nm³/hr. and mean dust concentration was about 12mg/Nm³. The mean concentration of dioxins discharged from stack was about 2ng/Nm³. Also the distribution rate of dioxins on gas and solid phase was 60:40.

Analytical Method

The soil samples were ground to make fine particle. These samples were dried to 130 °C in oven for a night. 10g of each samples was used in analysis of dioxins. These samples were treated with 2N HCl and dried in air. These samples were spiked with fifteen ¹³C-labeled compound 1.2ng and then extracted with toluene using accelerated solvent extractor (Dionex ASE200, USA). Extracts were concentrated to about 5mL and then dried by nitrogen gas. These extracts were treated with concentrated sulfuric acid, silica column and alumina column by USEPA 1613 method. Recovery standards 1.2ng was spiked in these extracts.

HRGC/HRMS analysis

PCDDs and PCDFs were analyzed by HRGC/HRMS (GC : HP6890 series(USA), MS : Micromass Autospec-Ultima (UK)). The fused capillary column used was SP-2331, 0.32 mm i.d.

ENVIRONMENTAL LEVELS II -POSTER

X 60m, 0.25 μm film thickness (J&W Scientific, USA). The column temperature was maintained at 100°C for 3min., heated to 200°C at the rate of 20°C/min., heated to 260°C at the rate of 3°C/min., and maintained at 260°C for 22min.. The injection temperature, source temperature and interface temperature were maintained at 260°C. The carrier gas flow pressure was 20 psi. The trap current, electron energy, emission current, filament current and detector voltage were 500 μA , 32eV, 0.88 mA, 4.32A and 300V, respectively. The concentrated samples 1 μl were injected.

Results and Discussions

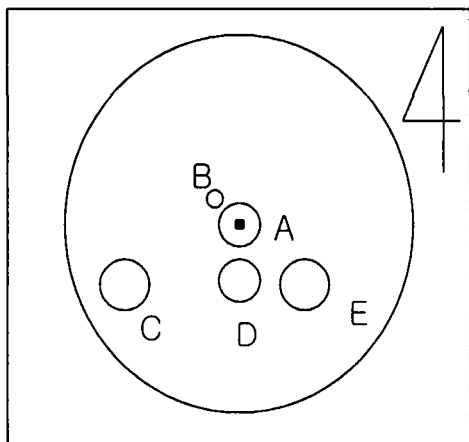


Figure 1. The sampling points and dioxin concentrations.

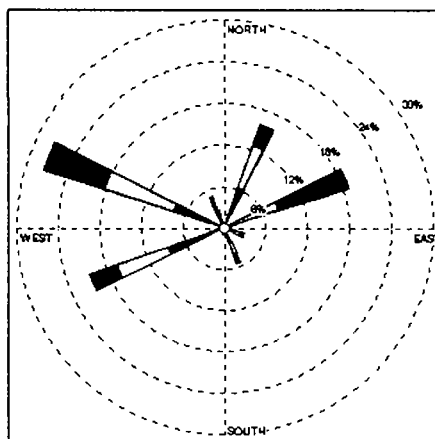


Figure 2 The wind rose diagram for a year in 2000.

Figure 1 shows sampling points and dioxin concentrations. A was a point of 5m distance from source. B, C, D and E were points of 1.6km, 5.0km, 4.0km and 6.0km distance from source. Figure 2 shows wind rose diagram for a year in 2000. As shown figure 1 and 2, concentrations of dioxins on direction were consistent with direction of wind. Table 1 shows concentrations of PCDDs and PCDFs in soils. This source discharges dioxins of much amount a time unit, but the height of stack is very high and flow rate is very rapid. Therefore, dispersion of gas and dust is started at far from ground. Also this result was lower value than European limit. The result from source of same kind was reported in UK. According to this report, concentrations of dioxins around source were 4.3 – 24.6pg-TEQ/g. As shown table 1, the concentrations of dioxins were 1.70 – 9.64pg-TEQ/g.

ENVIRONMENTAL LEVELS II -POSTER

Table 1. The concentrations of PCDDs and PCDFs contained in soils around MSWI.

Congener	A	B	C	D	E
	pg-TEQ/g				
2,3,7,8-TCDD	0.40	0.11	0.65	0.42	0.61
1,2,3,7,8-PeCDD	0.90	0.17	1.18	0.88	1.29
1,2,3,4,7,8-HxCDD	0.10	0.04	0.15	0.24	0.15
1,2,3,6,7,8-HxCDD	0.19	0.08	0.74	0.31	0.30
1,2,3,7,8,9-HxCDD	0.16	0.07	0.50	0.38	0.24
1,2,3,4,6,7,8-HpCDD	0.11	0.05	0.46	0.29	0.20
OCDD	0.06	0.04	0.32	0.32	0.11
Total PCDD	1.92	0.56	4.00	2.84	2.90
2,3,7,8-TCDF	0.38	0.08	0.67	0.60	0.59
1,2,3,7,8-PeCDF	0.15	0.04	0.20	0.21	0.24
2,3,4,7,8-PeCDF	2.35	0.57	2.61	1.75	3.53
1,2,3,4,7,8-HxCDF	0.40	0.11	0.48	0.35	0.65
1,2,3,6,7,8-HxCDF	0.39	0.11	0.45	0.27	0.58
2,3,4,6,7,8-HxCDF	0.47	0.14	0.52	0.24	0.70
1,2,3,7,8,9-HxCDF	0.13	0.05	0.13	0.09	0.14
1,2,3,4,6,7,8-HpCDF	0.14	0.03	0.21	0.09	0.27
1,2,3,4,7,8,9-HpCDF	0.02	0.01	0.02	0.01	0.02
OCDF	0.01	0.00	0.03	0.01	0.02
Total PCDF	4.38	1.14	5.32	3.62	6.74
Total	6.20	1.70	9.32	6.46	9.64

ENVIRONMENTAL LEVELS II -POSTER

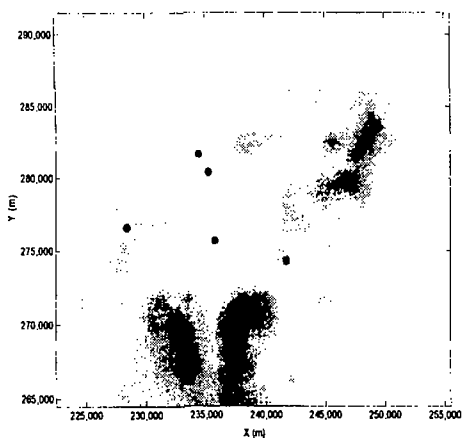


Figure 3. A result on distribution of dioxins of gas phase emitted from a specific source (A) by ISCST-3.

Figure 3 shows distribution of dioxins of gas phase emitted from a specific source. This diagram was accomplished by ISCST-3.

References

1. Raymond Fisher et al., Organohalogen compounds, 46, 471, 2000
2. Nestruck. T. J. et al., Chemosphere, 15, 1453, 1986
3. Kjeller. L. O. et al., Environ. Sci. Technol., 25, 1619, 1991