DIOXIN LEVELS AND CHARACTERISTICS IN AMBIENT AIR AND PLANTS IN MAJOR CITIES OF KOREA

Jong-In Dong , Sang-Bin Kim, Seong-Seok Seo, Kwoon-Uk Eum*, Jeong-Wean Ihm*,

Department of Environmental Engineering, The University of Seoul

Usentech*, Korea*

1. INTRODUCTION

Dioxins/furans are one of the most toxic and persistent human-made organic chemicals and their density increase in the natural world by incineration of chlorinated carbons and other chemicals [1)]. Dioxins are emitted into the atmosphere by various combustion processes including the incineration of municipal wastes and dispersed throughout the environment by atmospheric transport [2)]. Dioxins have been detected in biological samples and environmental samples including fish, marine and terrestrial mammalian wildlife, plants, soil and sediment [3)]. Total amount of dioxins/furans emissions into ambient air in Korea is estimated 1219~1246.7g-WHO TEQ in 2001. The largest emission source of dioxins in Korea is the waste incinerators emitting 87% of total amount and the second source is considered steel industry, which occupies 9%.

We investigated atmospheric levels of dioxins in major cities and industrial areas. Dioxin levels in the plants(pine needles and oaks) were also investigated for the same areas and at the same period. The objective of this study was to analyze the characteristics and levels of dioxins in urban areas and to find out the relationship between their levels in atmosphere and in plants.

2. EXPERIMENTAL SITES AND PROCEDURES

2.1 Sampling locations

Atmospheric and plant samples were collected in seven cities in South Korea during 2006 as shown in Fig. 1. The air samples were taken at the height of 3~10m form the ground. Plant samples were collected at the height of 1-2m from the ground and plastic gloves were used when handling the leaves. All samples were immediately packed in an aluminum foil and sealed in a plastic bag, and then shipped to the laboratory in an ice box. All samples were stored at -10℃ in the laboratory.

2.2 Analytical procedures

Plant samples were homogeneously cut into about 1 cm length. About 50g of plant was extracted with toluene for 24 hr under soxhlet. After extraction, extracts were filtered to remove a bulk of chlorophyll

using silica gel and then were concentrated to less than 3 ml in a rotary evaporator. After concentrating, concentrated sample were filtered to remove mono-PCB using activated carbon. Solution were pre-cleaned up with a multi-layer silica gel column chromatography; AgNO3 –silica gel, H2SO4 –silica gel and KOH-silica gel loaded into a 1.5 cm i.d x 25cm glass column and eluted with n-hexane. Eluents were concentrated to 10ml, and cleaned up with activated carbon column chromatography; activated carbon loaded into a 1 cm i.d. x 25cm glass column and eluted with 25% dichloromethane in n-hexane, toluene. This extracts were concentrated again. The purified extracts were dissolved with 50 ul of n-nonane and analyzed for each of the five chlorinated dibenzo-p-dioxin and dibenzofuran congener groups by HRGC/HRMS.

Fig. 1. Sampling points selected in this study

3. RESULTS & DISCUSSION

Temperature and wind speed at sampling points are show in Fig. 2. and ambient levels of other air pollutants are also shown in Fig. 3. Dioxin results are summarized in Table 1 and isomer patterns of dioxins are shown in Fig. 4. The highest concentration of dioxin was measured at Inchon and Siheong the second and Seoul the third. Other 4 cities' levels were much lower than Inchon, Siheong and Seoul. Metropolitan city. The levels in Inchon, Siheong and Seoul were higher than those in the steel industry regions(Powhang and Gwangwang). Ganghwa showed the lowest level and it is considered because Ganghwa could be an environmental background area in this study.

2,3,4,7,8-PeCDF level was the highest in all the isomers and 1,2,3,7,8-PeCDD was the highest in PCDD isomers.

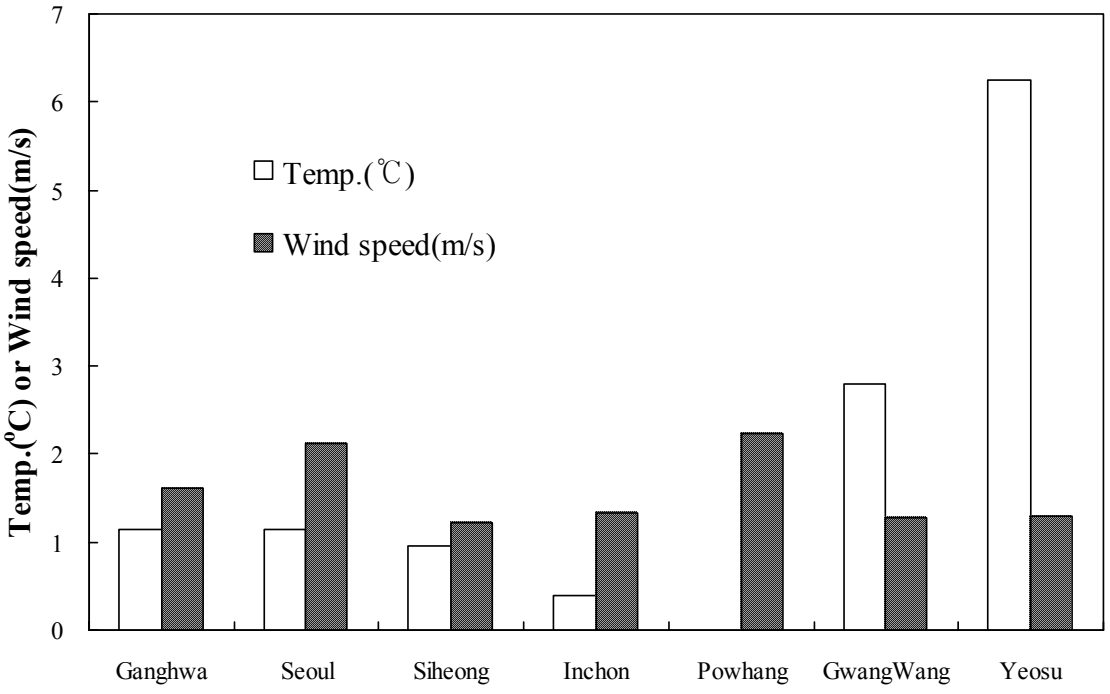

Fig. 2. Temperature and wind speed at sampling points

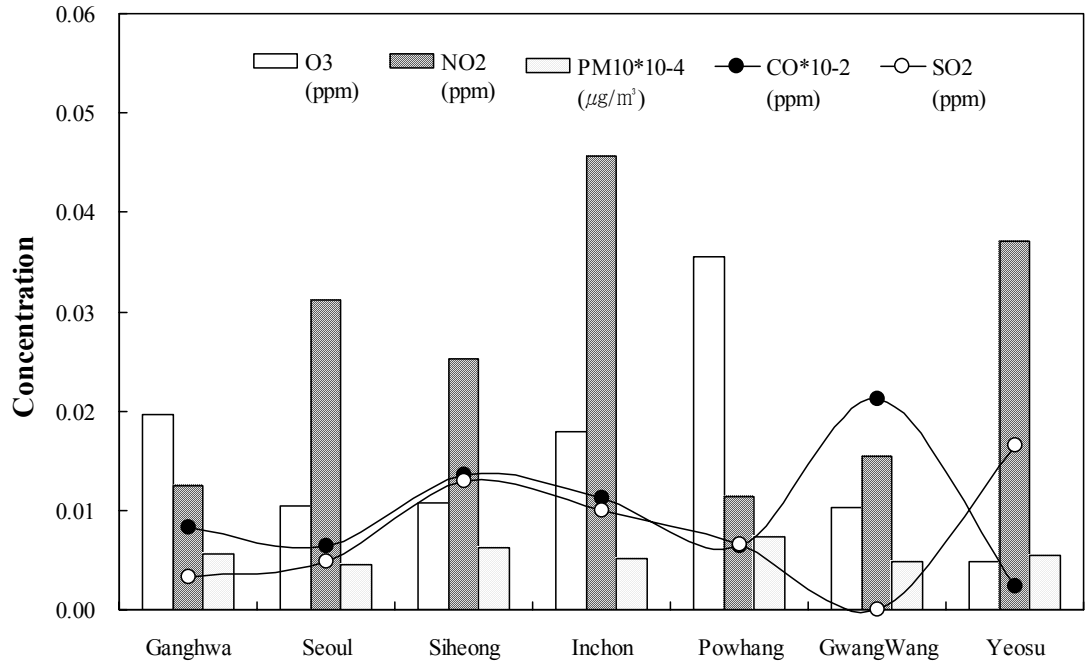

Fig. 3. Ambient levels of other air pollutants at sampling points

Table 1. Dioxin levels at each city

	Ganghwa	Seoul	Siheong	Inchon	Pohang	Gwangyang	Yeosu
Conc.(pg-ITEQ/Nm3)	0.035	0.227	0.271	0.394	0.033	0.044	0.016

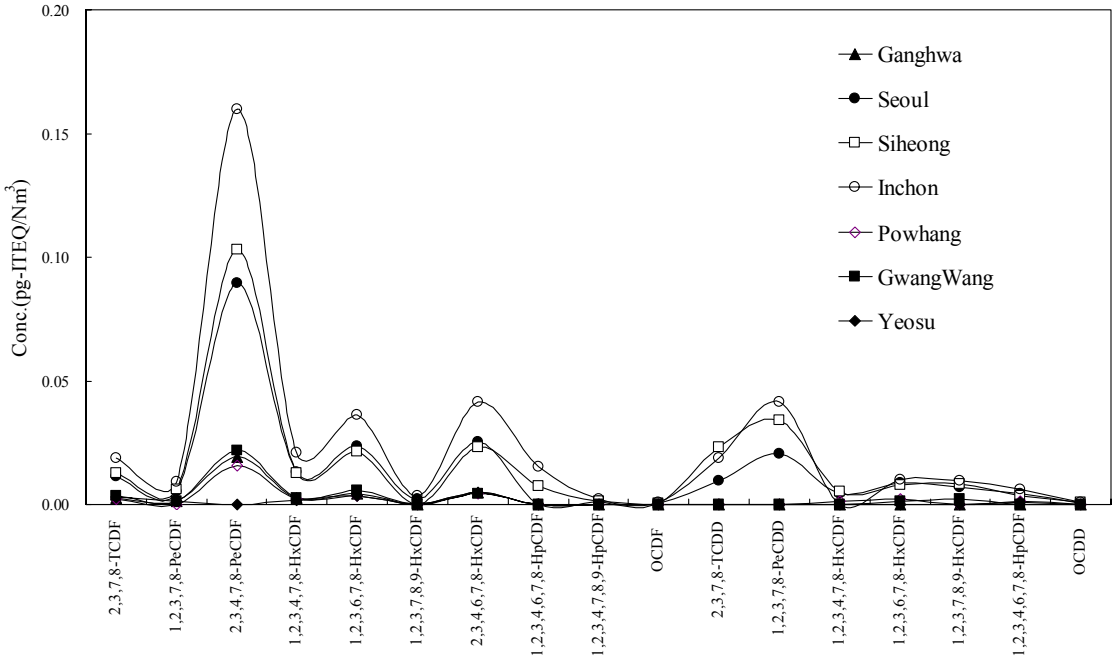

Fig. 4. Isomer patterns of dioxins at each city

4. CONCLUSION

The dioxins/furan levels in metropolitan cities(Inchon, Siheong and Seoul) were higher than the industrial regions (steel industry regions, Pohang and Gwangyang). Ganghwa showed the lowest level, which is consedered an environmental background area. Further studies are considered to be used to correlate these results with those levels in other environmental media.

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