Introduction
Persistent organic pollutant (POPs) exerts a fatal influence on ecosystem by toxicity, persistency, long-range transport, and biological accumulation. PCDDs/DFs (polychlorinated dibenzo-p-dioxin/polychlorinated dibenzofurans) among POPs were controlled as unintentional persistent organic pollutants (UPOPs) to Stockholm convention annex C fermented in 2004. Also PCDDs/DFs have strong persistency in environment because is very stable physical/chemically structure and hardly disintegrated to microorganism. It is waste incinerators, automobile exhaust gas, iron or nonferrous metal industrial facilities etc. to pollution source of dioxin and waste incinerators was grasped about 70% by main source, specially. PCDDs/DFs exhausted from main source can be spread to far away area and is settled by gravitational deposition or turbulence diffusion etc., finally exercises direct influence on human. That is, PCDDs/DFs accumulated in water or soil is exposed to human from food chain.

Therefore, in this study, we did comparative analysis the PCDDs/DFs isomer pattern in flue gas and atmosphere, water and soil using principal component analysis in multivariate statistical analysis. As this result, we wished to grasp PCDDs/DFs behavior in environment.

Materials and Method
Diffusion effect from source to ambient was confirmed as comparison with PCDDs/DFs isomer pattern of ambient and flue gas using principal component analysis. Also we evaluated long term behavior in environment as estimated PCDDs/DFs isomer pattern of soil and water.

Selected ambient sample (n=67) in this study is surrounding atmosphere of incinerators and sampling time is more than 24 hours. And flue gas sample (n=82) was consisted of medical waste incinerators (n=3), industrial waste (n=70), and MSW (n=9) and sampling time is more than 4 hours and O₂, NOx, CO and Co₂ measured to interval 5 minutes as air pollutant. Water sample (n=54) was consisted of river (n=45), lake (n=6), and effluent (n=3) (Ref. 1). Soil sample (n=33) was consisted of orchard (n=2), rice field (n=16), building surrounding soil (n=5), ground (n=2), road (n=1), stock farm (n=1), forest land (n=2), and farm (n=4) (Ref. 1).

Remove statistical propensity by chemical concentration difference through data normalization before apply multivariate statistical analysis. We did principal component analysis using normalization data by SAS (SAS institute, 9.0, USA).
Result and Discussion

PCDDs/DFs concentration of ambient is 0 ~ 15 ng/Sm³ (avg. 1 ng/Sm³), flue gas is 0 ~ 319 ng/Sm³ (avg. 17 ng/Sm³), water is 1 ~ 7 pg/L (avg. 3 pg/L), and soil is 0 ~ 19 ng/g (avg. 1 ng/g). Incinerator that most high concentration PCDDs/DFs is measured is medium size incinerator of medical waste.

Fig. 1 shows that 2,3,7,8 - substitute isomer (17 kinds) of PCDDs/DFs was separated by 4 groups using principal component analysis. Group 1 (n=46) is consisted of flue gas (n=34) and ambient (n=12), respectively and Group 2 (n=24) is only flue gas. Group 3 (n=58) is consisted of flue gas (n=24) and ambient (n=34) and Group 4 (n=11) is only ambient. PCDDs/DFs isomer pattern of ambient in same area is separated as Group 1 and Group 3. That is, because of difference of PCDDs/DFs exhausted from incinerators, PCDDs/DFs of ambient in same area was measured to differ.

PCDDs/DFs isomer pattern according to each group arranged to Fig. 3. The ratio of PCDFs and PCDDs is 61 : 39 in Group 1, 66 : 34 in Group 2, 77 : 23 in Group 3, and 97 : 3 in Group 4. Also, dominate isomer in all group excepting group 4 is 1,2,3,4,6,7,8-HpCDF (more than 15%) but 1,2,3,7,8-PeCDF (26%) in Group 4.

Fig. 2 shows that PCDDs/DFs isomer was separated as 2 groups using principal component analysis. Group 1 (n=63) is consisted of water (n=32) and soil (n=31) and Group 2 (n=24) is water (n=22) and soil (n=2), respectively. PCDDs/DFs isomer pattern of most soils are included to group 1.

Isomer pattern according to each group arranged to Fig. 4. The ratio of PCDFs and PCDDs is 11 : 89 in Group 1 and 25 : 75 in Group 2. Dominate isomer is OCDD (about 83%) in Group 1, and OCDD (about 64%) and 1,2,3,4,6,7,8-HpCDF (about 22%) in Group 2.

1,2,3,4,6,7,8-HpCDF is dominate isomer in ambient and flue gas, and soil and water is OCDD. Also, soil and water is higher PCDDs than PCDFs contrary to atmosphere and flue gas. OCDD is very stable as physicochemical construction than other isomer. Thereby we estimated that OCDD ratio was increased as long-term behavior in soil and water. Also, similar reason such as this result was applied in ratio of PCDDs and PCDFs.
Soil and water display similar isomer pattern by affects of deposition process of PCDDs/DFs from ambient. But settled PCDDs/DFs to soil from ambient is influenced from various factors for long-term behavior, thereby soil and water differs very with PCDDs/DFs isomer pattern of ambient.

**Conclusion**

2,3,7,8 - substitute isomer (17 kinds) of measured PCDDs/DFs separated as 4 groups in ambient and flue gas and 2 groups in soil and water using principal component analysis as multivariate statistical analysis after normalize.

1,2,3,4,6,7,8-HpCDF is dominate isomer in ambient and flue gas, and soil and water is OCDD. Also, soil and water is higher PCDDs than PCDFs contrary to atmosphere and flue gas. Soil and water display similar isomer pattern by affects of deposition process of PCDDs/DFs from ambient. But settled PCDDs/DFs from ambient is influenced from various factor for long-term behavior, thereby soil and differs very with PCDDs/DFs isomer pattern of ambient.

**Reference**


