EVALUATION OF AIR POLLUTION, ORIGIN AND ACCUMULATION BY POLYCYCLIC AROMATIC HYDROCARBONs (PAHs) USING INDICATOR FOR GINGKO LEAF IN BUSAN KOREA

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Abstract
In this study, gingko leaf were used which is to monitoring and investigation for air pollution assessment by passive sampler, because of these Gingko plants leaves are widely distributed in the Korea. During the growth of plants leaves, assessment of air pollution levels and sources as well as bio-accumulation rate by exposure of PAHs from ambient air. Sixteen priority PAHs concentration in Gingko plant leaves for all site varied between 123 and 745 ng/n d.w. with an average concentration of 367 ng/n d.w.
Overall, sixteen priority PAHs in Gingko plant leaves exhibited for spatial distribution of concentration levels the sequence industrial area (I) > intersection point (TI) > residential area (R) > in intersection contiguity residential area (TR) and the concentration level appeared by 468, 409, 363, 244 ng/n d.w. each other. Origin is suggested that petrogenic of gasoline and diesel emission with combustion of pyrogenic origin by multiple contamination origins. Average accumulation rates (AR) were calculated by growth time(exposure time) of gingko leaves in natural condition, and the results presented followed, residential area is average 44ng/g d.w/month, intersection is average 51ng/g d.w/month, residential area of intersection surrounding is average 28ng/g d.w/month, and industrial area average 56ng/g d.w/month, respectively.

Introduction

Sources of PAHs are very various and ubiquitous substances in the environment. PAHs have important sources, which are imperfect combustion process such as coal, family heating that use fossil fuel of oil and various industrial facilities such as power plant, aluminum smelting process, coke and asphalt manufacturing process, wood conservation facilities, forest fire, incinerator, cooking, cigarette smoke etc. Specially, automotive exhaust gas too, was reported for one of main origination. [1-4]
Organic chemicals such as PAHs have important atmospheric process and control which a distribution by particle and gas phase, long rang transport and remove from the atmosphere by dry and wet deposition process.[5] And, PAHs of gas and particle phase through the deposition process and scavenging can be accumulated to soil or vegetation in environmental. [3,6-7]
Main pathways for the uptake of SOC such as PAHs in plant leaves that were soil via roots, air deposition and vapor intake from the air. Particularly, from the air to leaf intake of gas phase SOCs can be considered most important process, and it was indicated that leaf bioconcentration was dependent upon ambient temperature and concentration during growing of plants.[8-12]
After 1990 utilized as passive biomonitoring system to investigate for bioaccumulation and monitoring of POPs such as dioxins in the atmosphere during the growth period of plant. This access considered the adsorption capacity by wax component of plant, and particularly, pine needle is proved usefulness of Bioaccumulation estimation about plant concentration and air pollution monitoring of SOCs by one of the indicator media of representative plant. [13-19]
In this study, gingko leaf were used which is to monitoring and investigation for air pollution assessment by passive sampler, because of these Gingko plants leaves are widely distributed in the Korea. During the growth of plants leaves, assessment of air pollution levels and sources as well as bio-accumulation rate by exposure of PAHs from ambient air.

Materials and Methods

-Sampling-

In this study, samples were collected on October, 2004, and sampling station was designed to classification in

Pusan area by residential area (R), heavy traffic area (T), industrial area(I). Specially, heavy traffic area(T) were classified by intersection(TI) and intersection surrounding residential area(TR), and it was selected by 17 sampling site. Fig.1 shows classification of sampling site for gingko sampling.

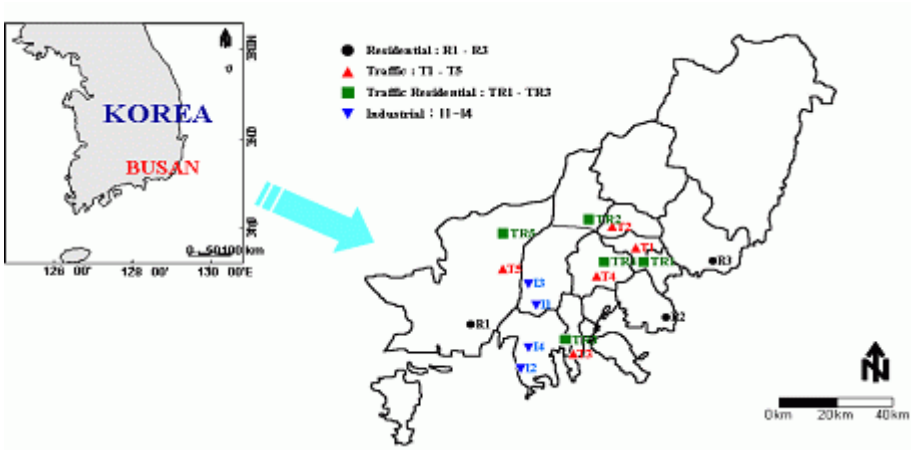

Fig. 1. Map of sampling stations in Busan, Korea.

-Extraction and clean up-

Gingko plant leaves sample were collected in about 2-4m from surface ground, and samples were shade the light by zipper pack with aluminum foil and after moved to a laboratory immediately freeze-dried and cut off(0.2 x 0.2cm) at -20℃ stored until extraction. Samples were extracted for 16hr using Toluen(Ultra residue analysis, J.T. Baker) in a Soxhlet extractor

The extracts were filtered out all the chlorophyll using silica gel (Merck, 70 - 230mesh, neuter gender) about 50 ～100 g in the extraction samples and the extracts were evaporated to concentrates about 10 mL, after evaporated almost dryness by N2 gas to conversion solution of 10ml n-hexane for clean up.

For clean up, samples were passed through 10g of activated silica gel (70-230 mesh, Merck, Co.) packed in a glass column chromatography. Sixteen priority PAHs were used gas chromatograph/mass spectrometer(GC/MSD, Shimadzu GC/MS-QP2010), and capillary column was used HP-5MS(30m x 0.32 ㎜ x 0.25 ㎛). A detailed descriptions of the clean up procedures for PAHs have been presented elsewhere.[17]

Results and Discussion

- concentration levels of Gingko plant leaves -

Fig. 2 shows the average concentration of sixteen priority PAHs in Gingko plant leaves for each group. Sixteen priority PAHs concentration in Gingko plant leaves for all site varied between 123 and 745 ng/n d.w. with an average concentration of 367 ng/n d.w.

Overall, sixteen priority PAHs in Gingko plant leaves exhibited for spatial distribution of concentration levels the sequence industrial area (I) > intersection point (TI) > residential area (R) > in intersection contiguity residential area (TR) and the concentration level appeared by 468, 409, 363, 244 ng/n d.w. each other.

Especially, in the case of industrial area, concentration level investigated higher than heavy traffic area. Such reason is thought that at same time received effect of facility stack flue gas by combustion of fuel as well as of exhaust gas from vehicles.

Also, six priority carcinogenic ∑ PAHcarc. Spatial distribution of average concentration in Gingko plant leaves for all station samples exhibited sequence Industrial area(23.7 ng/n d.w.) > Traffic intersection area(15.9 ng/n d.w.) > Traffic Residential area(9.7 ng/n d.w.) > Residential area (4.7ng/n d.w.) each other.

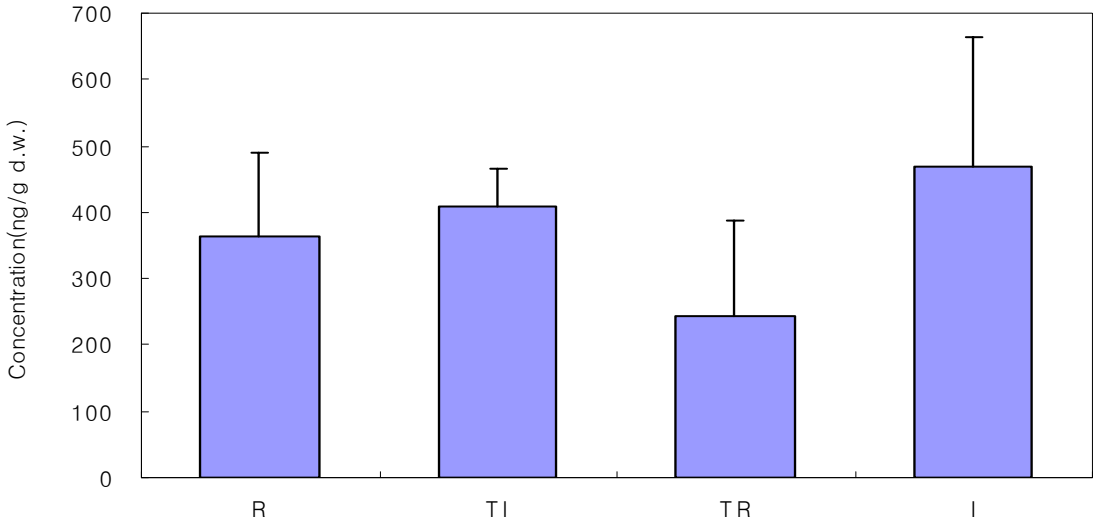

Fig. 2. Concentration levels of sixteen priority PAHs in gingko plant leaves for each site.

-PAHs source identification-

In order to source identification and discrimination of PAHs in environmental receptor media and sources, especially that using ratios were calculated by specific indicate compounds to distinguish between origins such as pyrogenic and petrogenic from concentration of specific PAHs compounds.

Yunker et al . (2002)[18] applied and proposed that for Anthracene(AnT)/Phenanthrene(PhA) vs Fluoranthene(FluA)/ Fluoranthene+Pyrene(FluA+Pyr) of ratio to indicate compounds, and Indeno(1,2,3-c,d)pyrene(InP)/ Indeno[1,2,3-c,d]pyrene+Benzo[g,h,i]perylene(InP+BghiP) vs Fluroanthene(FluA)/ Fluoranthene+Pyrene(FluA+Pyr) to the estimation of origins by ratio of indicate compounds to pyrogenic and petrogenic for PAHs from samples.

Fig.3 shows to cross-plot for AnT/PhA vs. FluA/(FluA+Pyr) and InP/(InP+BghiP) vs. FluA/(FluA+Pyr) to estimate of PAHs origins from gingko leaf samples in this study. As can know in Fig.3, generally, calculated results which is presented for AnT/PhA< 0.1, and FluA/(FluA+Pyr) < 0.4 , can be assumed that effect of oil origin such as diesel and gasoline emission by petroleum fuels as well as that effect of oil origin such as Diesel emission with combustion exhaust gas from fuel by 0.2< InP/(InP+BghiP)< 0.5 and FluA/(FluA+Pyr) < 0.4 values, so that origin is suggested that petrogenic of gasoline and diesel emission with combustion of pyrogenic origin by multiple contamination origins. Therefore, from this result suggested that usefulness for leaves of plants using by the indicate media of PAHs monitoring to the investigation of contamination origins in atmosphere. But, need a lot of statistical data to estimation of SOCs pollution source such as PAHs. In the case of Korea, usefulness was confirmed as Passive Bio-Monitoring System for assessment of SOCs in the atmosphere, while gingko plants becomes many tree planting in roadside as roadside tree, and to the assessment in environment such as estimation of origination as well as bioconcentration of vegetations through air that gingko leaves is suggested usefulness indicate receptor media.

PAHs Accumulation Rates

Average accumulation rates(AR)[19] were calculated based on measurement concentration and age(time)of gingko leaves, and was evaluated as following; AR was expressed as $AR = C_t / t$, where C_t is the average concentration of compounds in gingko leaves at age t (month). In this investigation, according to measurement result of PAHs that average accumulation rates (AR) were calculated by growth time(exposure time) of gingko leaves in natural condition, and the results presented followed, residential area is average about 44ng/g d.w/month, intersection is average about 51ng/g d.w/month, residential area of intersection surrounding is average about 28ng/g d.w/month, and industrial area was calculated by average about 56ng/g d.w/month, respectively.

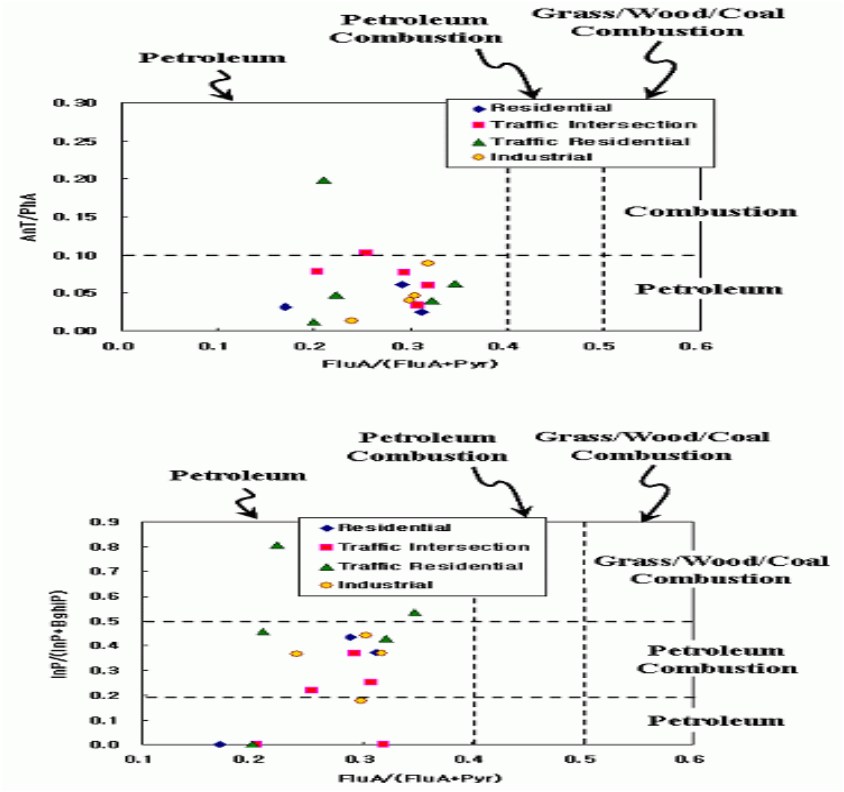

Fig.3. PAHs cross plot for the ratio of (a)AnT/PhA vs. FluA/(FluA+Pyr), (b)InP/(InP+BghiP) vs. FluA/(FluA+Pyr) in gingko.

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