SURVEY ON CONTAMINATION CHARACTERISTICS OF POLYCYCLIC AROMATIC HYDROCARBONS(PAHs) IN SOIL IN SEOUL, KOREA

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Introduction

Polycyclic aromatic hydrocarbons (PAHs) are serious and ubiqitous environmental contaminants. A typical and important source of PAHs emission into the environment is the incomplete combustion of fossil fuel and organic materials, cause from incinerators, residential heating, power generator and industrial facility [1,2]. Some of PAHs, Including Benzo[a]pyrene (BaP), were indicated mutagen and carcinogen, namely Endocrine Disruptors (EDs) in view of the environmental toxicology [3]. BaP is one of the PAH compounds. Because it is formed when gasoline, garbage, or any animal or plant material burn, it is usually found in smoke and soot. This chemical combines with dust particles in the air and is carried into water and soil and onto crops. BaP is found in the coal tar pitch that industry uses to join electrical parts together. It is also found in creosote, a chemical used to preserve wood. PAHs release in the air, transferring into soil with deposition and thus contaminate soil and water as infinitesimal toxic pollutant [4].

The objective of this study is to understand the concentration level and characteristic of PAHs in soil and to use them as fundamental data for environmental estimation of persistent organic pollutants (POPs) in Seoul, Korea.

Sampling and Analysis

Sites

The collection and analysis of samples (30cm× 30cm× 5cm/each) have been performed in May 2000 to investigate the contamination characteristics of PAH compounds in soil for 33 sites, which were classified as four main group such as traffic, factory, incineration and mountain in Seoul. Sampling sites in this study are shown in Table 1 and Fig. 1.

Seoul is the capital city of Korea, where is famous for serious congestion of traffic with a population of about 10,000,000 and about 2,300,000 automobiles registered (over 5,100,000 vehicles at metropolitan area of Seoul) [5].

Table 1. Characteristics of sampling site and number

Group	Area	n	Group	Area	n
Traffic	Kwanghwamun (TK)	5	Mountain	Bukhan Mt.(MB)	4
	Kangnam (TG)	4		Nam Mt. (MN)	4
	Youido (TY)	3		Daemo Mt.(MD)	3
Factory	Kuro (FG)	3	Incineration	Mokdong (IM)	4
	Sungsu (FS)	3			

(n=sampling numbers).

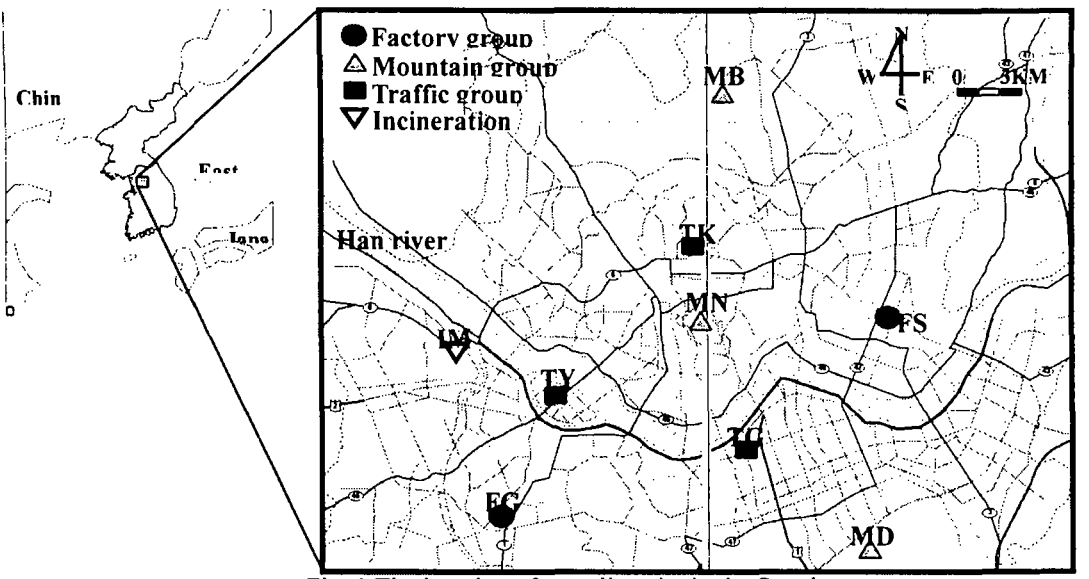


Fig. 1.The location of sampling site in the Seoul.

Analysis

Samples were collected from the surface at each site and sieved with a 30-mesh sieving screen (pore size <500 ㎛) to remove large particles, such as leaves of plants and stones, etc. 20 g of each soil sample were extracted with 200 ㎖ toluene for 8 hours in a reflux extraction system for PAHs analysis. After extracted, samples were filtered and concentration to 10 ㎖ by rotary evaporator.

Extracts were transferred to *n*-hexane and internal standard (ES 2055 ; Deuterated PAHs solution, Cambridge Isotope Laboratories, Inc) was spiked. Extracts were clean up on an activated silica gel column with successiveiy eluted of *n*-hexane and 15% methylene dichloride in *n*-hexane. The second fraction was concentrated to less than 1 ㎖, and left at a room temperature for one or two days to evaporate to 200 ㎕. The residue was dissolved with 200 ㎕ of *n*-nonane and determined for PAHs [6].

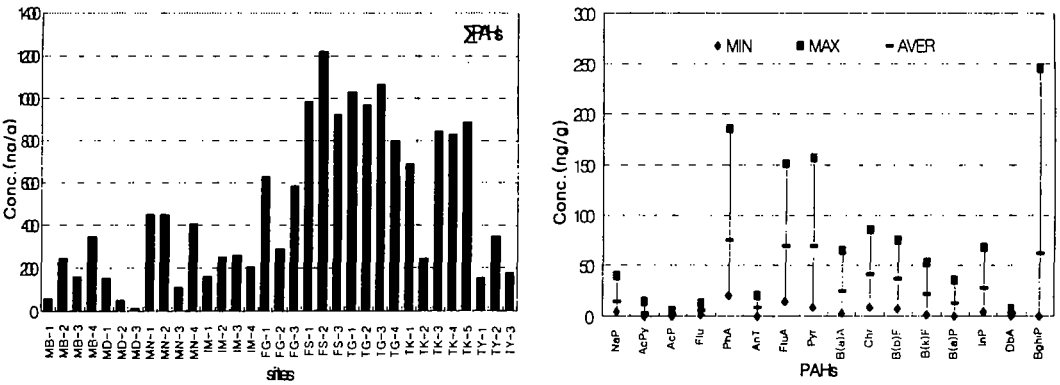
The GC/MS-SIM (Selected Ion Monitoring) anaiysis were carried out using HP6890 plus chromatograph coupled with a HP5973 mass spectrometer and equaled with HP-5MS capillary column.

Result and discussion

PAHs concentration in soil

Total 16 PAHs (sum of two- to six-ring PAHs) concentrations at 33 sampling sites were shown in Fig. 2. (a). Total PAHs concentrations ranged from 14.66 to 1,219.35 ng/g, which were very related with environmental characteristics of four sampling groups. The highest concentration levels occurred at Sung su-2 (FS-2) and Gang nam-3 (TG-3) sites with 1,219.35 ng/g and 1,064.20 ng/g respectively. Daemo Mt.-3 (MD-3) site presented the lowest levels (14.66 ng/g) compared with the other sites. In case of FS, TG and TK groups were heavy traffic areas, specially FS group, the highest concentration, has many factories that does not have reduction pollutant system. PAHs concentration levels at mountain group (MB, MD and MN area) were lower than those of factory

and traffic groups (FS, TG and TK areas). MN-1, MN-2 and MN-4 showed higher concentrations than average value of the mountain area, suggestion that these areas were already influenced by automobile emission. From results, soils in Seoul were widely contaminated with PAHs, and thus PAHs should be considered as a main pollutant for further soil.

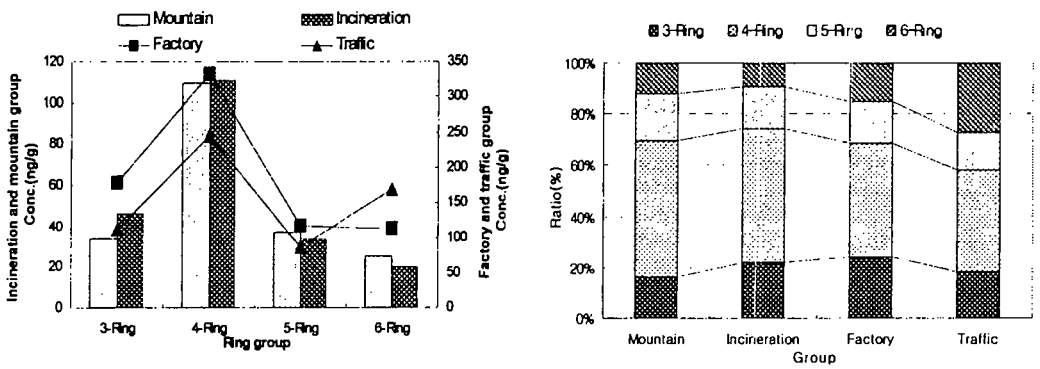


(a) (b)

Fig. 2. Total concentration of 16 PAHs for each site (a) and concentration of 16 PAHs in soil (b).

PAHs distribution characteristics in soil

Average concentration for ring-group in each group (a) and relative ratio of each compound within ring in each group (b) are shown in Fig. 3. PAH compounds of 4, 5, 6-rings show high concentration and production rates in the traffic and factory groups, indicating also that the concentration level of PAHs has a high correlation with mobile sources.



(a) (b)

Fig. 3. Average concentration for ring-group(a) and relative ratio of each compound within ring(b) in each Group.

2.3 Comparison with PM_{10} in the air

Using the airbone particles 10 microns in diameter and smaller, called PM_{10}, data [7] that it was publishes the monthly report on air quality at the ministry of environment, has a correlation with 16 PAHs. PM_{10} has also a correlation with 16 PAHs and its result was in Fig. 5. As a consequence of this survey, PAH compounds were absorbed on the micro particles and transferred into soil over widespread region in various processes such as particle's deposition and diffusion.

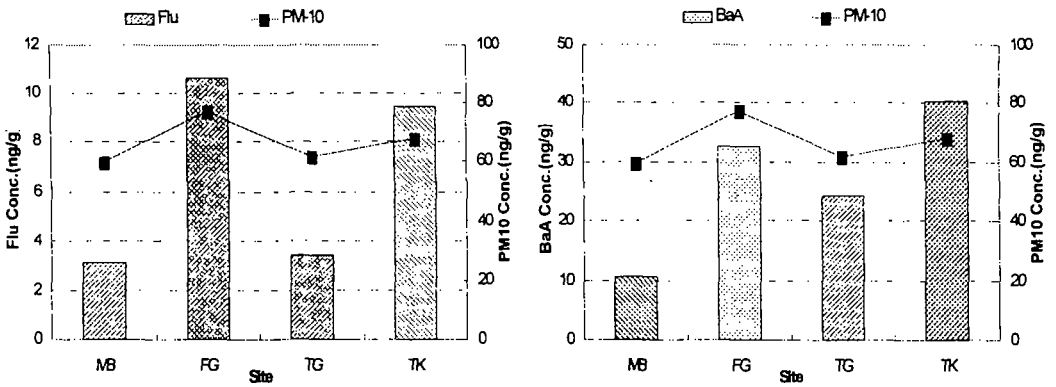


Fig. 5. Comparison between ∑ PAHs With PM_{10}.

Reference

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