

PA5) Characterization of Polycyclic Aromatic Hydrocarbons(PAHs) in PM₁₀ in Ulsan

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1. Introduction

Polycyclic aromatic hydrocarbons (PAHs) are a group of organic compound consisted of two or more fused aromatic rings. PAHs are considered as one of the first atmospheric pollutants and some of them were identified as carcinogens. Inhalation of carcinogenic or hazardous PAHs in particulate mixture is potentially a serious health risk. Thus, the studies on PAHs contented in PM₁₀ have become to concern in environmental field in recent years. The vehicular emission, residential heating, industrial activities, incineration and power generation are major sources of PAHs in many cities. It has been estimate that stationary sources contribute approximately 90% of total PAH emissions, but this is not true in urban and suburban areas, where the mobile sources are prevailing (Baek et al. 1991). The purpose of this study is to investigate characteristics of PAHs in airborne PM₁₀ collected from 3 sites which have different environment in a typical industrial city, Ulsan, in Korea.

2. Method and Materials

Airborne particulates were collected in spring and summer 2009 at a downtown area (DT), a residential area (RS) and an industrial area (IC) of Ulsan. Airborne samples for residential and downtown area were collected from Mugeodong and Samsandong office roofs which were located in a typical residential area and a downtown (city center) area, respectively. As there were busy traffic roads near these two sampling sites, approximately, their samples would be influenced by traffic emissions. The sample site for industrial area was located in Bukogdong near a petrochemical complex area of Ulsan. Figure 1 shows three sampling sites. PM₁₀ samples were collected using a high volume air samplers on a quartz fiber filters.

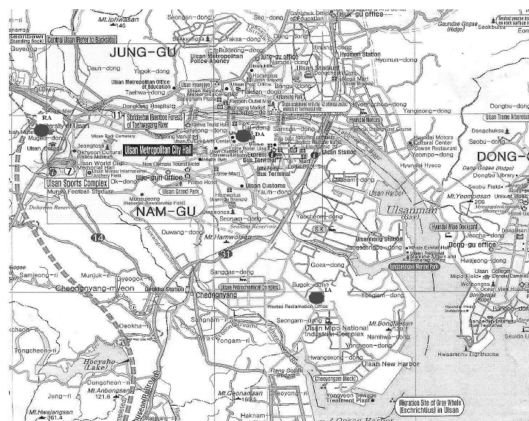


Fig. 1. Sampling sites of airborne PM₁₀ in Ulsan.

Quartz fiber filters were through cut into small pieces in a vial by a stainless scissors. Then the

samples were extracted three times with 30 ml of a mixture of n-hexane and dichloromethane (1:1, v/v) in ultrasonic bath at room temperature; the extract was filtered and then concentrated to 1 ml by a nitrogen concentrator at 30°C. Sixteen priority PAHs were analyzed by HPLC system.

3. Results and Discussion

The average PM₁₀ concentrations during the study period were shown in Table 1. The highest concentrations of PAHs were found at the downtown area in spring and at industrial area in summer, respectively. The residential area has lowest PM₁₀ concentration during both seasons. The average concentrations of PM₁₀ in spring were much higher than in summer at three sites.

Table 1. PM₁₀ concentration in three sites of Ulsan during spring and summer(μg/m³).

	Downtown Area	Residential Area	Industrial Area
Spring	70.18 ± 28.73	35.88 ± 8.4	63.63 ± 20.28
Summer	39.36 ± 18.41	30.82 ± 13.75	42.24 ± 27.16

PAH concentrations in PM₁₀ in the different sampling sites during the spring and summer were shown in Fig. 1. The average PAH concentrations were 34.96, 24.77, 30.89 ng/m³ in spring, and 22.31, 20.69, 22.29 ng/m³ in summer for DT, RS and IC, respectively. The spring average concentrations were higher around 1.2-1.4 times than the summer ones. The highest PAH concentrations were identified in the downtown area followed by the industrial area for both seasons, spring and summer. The concentration difference of the PAHs among the three sites were higher in spring than that in summer.

Fig. 3 shows the analysis of molecular weight distribution of the PAHs in all three sites. Medium molecular weight (MMW) PAHs with 4-aromatic rings were most abundant during both seasons in all the sampling sites except the industrial site in spring which shows low molecular weight (LMW) PAHs with 2-or 3-aromatic rings as major PAHs compounds. The industrial samples show quite

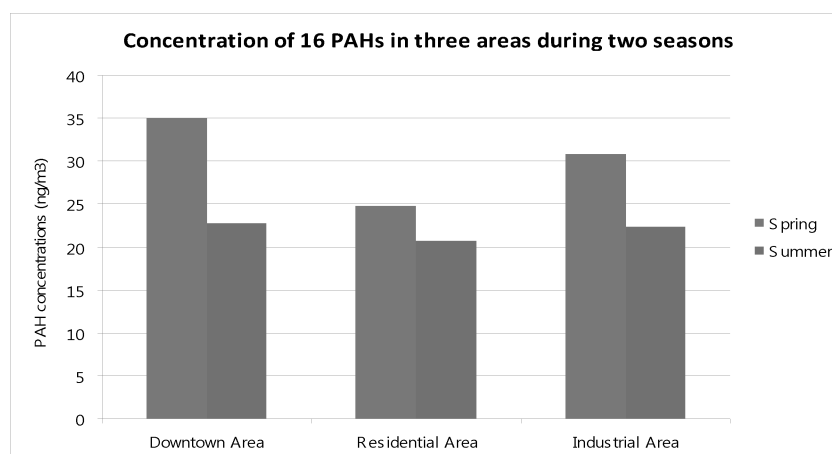


Fig. 2. PAHs concentrations in PM₁₀ in three sites of Ulsan during spring and summer.

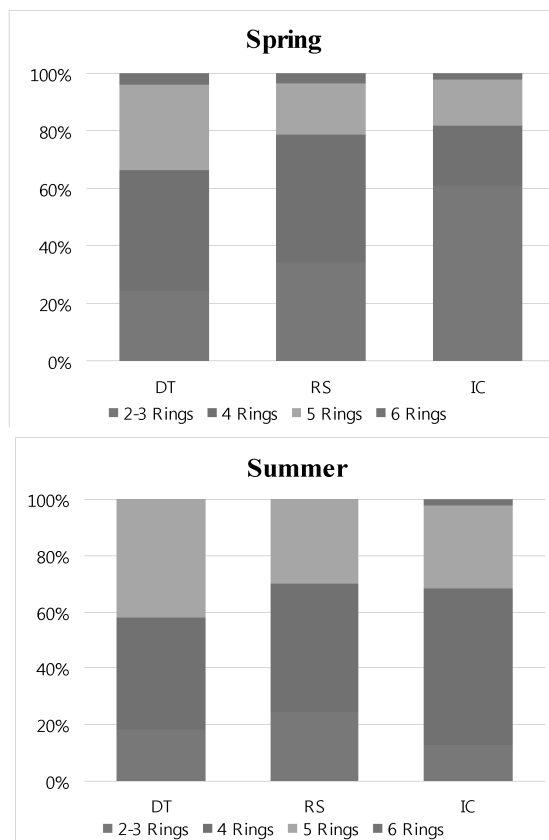


Fig. 3. Molecular weight distribution of PAHs in PM₁₀ in two seasons.

different pattern in molecular weight distribution of PAHs from urban samples including residential and downtown areas. The summer season shows the increased fractions of high molecular weight (HMW) PAHs with 5-aromatic rings. However, the fraction of LMW PAHs much reduced in summer. This is may be due to volatilization of LMW PAHs which have relatively high vapor pressure during the hot season.

4. Conclusion

The highest total PAH concentrations were found in the downtown area followed by the industrial area highly affected by traffic emissions. The average total PAH levels in spring were higher than these in summer. The difference in ambient temperature associated with anthropogenic activities between spring and summer may cause for the different molecular distribution of PAH in PM₁₀.

References

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