Environmental Occurrence of Polycyclic Aromatic Hydrocarbons and Nitro-Polycyclic Aromatic Hydrocarbons in Particulate Matters in Ho Chi Minh City, Viet Nam and Osaka, Japan

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Environmental Occurrence of Polycyclic Aromatic Hydrocarbons and Nitro-Polycyclic Aromatic Hydrocarbons in Particulate Matters in Ho Chi Minh City, Viet Nam and Osaka, Japan

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1. Introduction

Polycyclic aromatic hydrocarbons (PAHs) and nitro-polycyclic aromatic hydrocarbons (NPAHs) associated with particulate matters are much concerned in the last decade because of their toxicity affecting on human health as well as their existing everywhere in atmosphere. With the increase in fossil fuel use, resulting from industrialization and urbanization processes, traffic and population growth, over the past years, concentrations of PAHs and NPAHs in the atmosphere in Asian Countries are thought to be high. In Viet Nam, especially in big cities such as Ho Chi Minh and Ha Noi, air pollution issue is one of major environmental concerns and is likely to be causing significant health impacts. However, the detailed study about harmful substances such as PAHs and NPAHs in particulate matters in Viet Nam has not been reported.

In this work, we have investigated the concentrations of some PAHs and NPAHs at two different urban environments: in Ho Chi Minh City, Viet Nam and Osaka, Japan. The purpose of the measurements is to determine environmental concentration levels and distribution of PAHs and NPAHs at some different sampling sites in urban areas so as to assess the effects of air pollution of these harmful substances. Besides, with different climate characteristics and air pollution levels, the results will give information about the factors affecting on different distributions of PAHs and NPAHs at both cities.

2. Experimental methods

Airborne particulate matters (TSP) were colleted on quartz fiber filter using a high volume air sampler at some sites in Ho Chi Minh and Osaka during several consecutive months in 2005.
In Ho Chi Minh City (HCMC), Viet Nam, the sampling was carried out at two sites: one near the roadside and the other one in the residential area. Sampling frequencies were four times a month for residential area and two times a month for the roadside (From Jan. – Sep. 2005).
In Osaka, TSP were collected at one residential area from Apr. to Dec. 2004 (4 times a month) and at roadside area with high traffic density in Dec. 2004; Jul. and Dec. 2005.

12 PAHs (Phenanthrene (Phe), Fluoranthene (Fluo), Pyrene (Py), Triphenylene (Tri), Benzo[*a*]anthracene (BaA), Chrysene (Chr), Benzo[*e*]pyrene (BeP), Benzo[*b*]fluoranthene (BbF), Benzo[*k*]fluoranthene (BkF) Benzo[*a*]pyrene (BaP), Benzo[*ghi*]perylene (BghiP), Indeno[1,2,3-*cd*]pyrene (InP)) and 2 nitro-PAHs (2-nitrofluoranthene (2-NF) and 1-nitropyrene (1-NP)) associated with particulate matters were analyzed using high performance liquid chromatography with fluorescence and chemiluminescence detections, respectively.

3. Results and discussion

3.1. Distribution profiles of PAHs

Distributions of PAHs were different in two sampling environments HCMC and Osaka. In both environments, concentrations of PAHs were higher in roadside than those in residential area. Distribution profiles of PAHs in HCMC were similar in roadside and residential area, where BghiP,

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BeP, InP and BbF showed relatively high concentration amongst all PAHs investigated. On the other hand, in Osaka concentrations of BeP, Py, Fluo, BbF and Tri were higher in all PAHs. Distributions of individual PAHs in particulate matters in residential area were shown in Fig.1. The cause of the difference may relate to different climate conditions and emission sources between two cities, namely the temperature changes so much from season to season in Osaka and the transportation is also different in two cities. Because of the increase of PAHs from near the traffic road to residential site and BghiP were found to be highest in HCMC, it is proposed that the emission from vehicles is the main source of PAHs.

The result also shows that the total of concentration of 12 particle-associated PAHs measured in this study were higher in rainy season than that in dry season in HCMC, Viet Nam and higher in winter than in summer in Osaka, Japan.

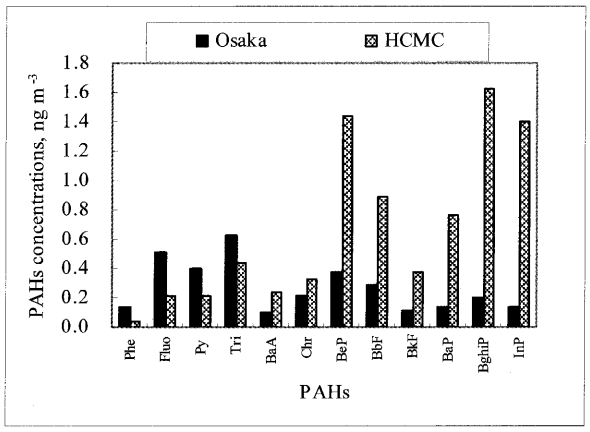

Fig 1. PAHs distribution profiles in TSP in the residential area in Osaka and HCMC

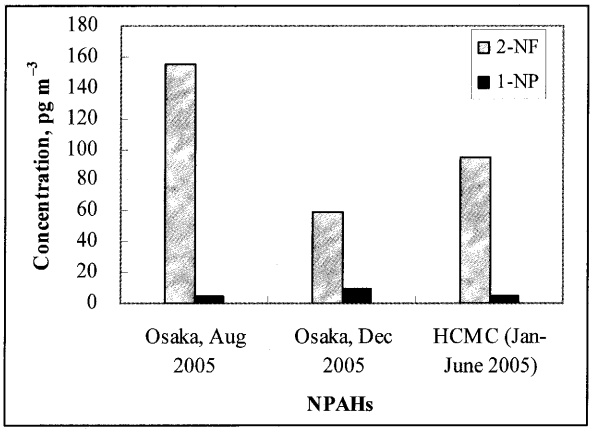

Fig 2. 2-NF and 1-NP in TSP in the residential area in Osaka and HCMC

3.2. NPAHs: 2-NF and 1-NP

The concentration of 2-NF was much higher than that of 1-NP and the concentrations near the roadside were higher than those in residential area in both cities. 2-NF concentration was lower in winter than in summer, whereas 1-NP concentrations were higher in winter in Osaka (Fig 2.). The ratio of 2-NF/1-NP in Osaka in summer was several times higher than that in winter. This could be explained by the difference in the source of both NPAHs. Since 2-NF is formed from the gas-phase reactions of fluoranthene with OH radical in the presence of NO_x and with N_2O_5, gas-phase reactions to form 2-NF take place actively during summer with high solar radiation to result the increase of this ratio. In the meanwhile, 1-NP is directly emitted and its concentration decreased due to the photochemical degradation in summer. The ratios of 2-NF/1-NP obtained in HCMC from Jan. to May. dry season 2005 were high and were comparable with that during summer season in Osaka. As for seasonal variation of NPAHs in HCMC, we can not give any conclusions at present because of the lack of the date in rainy months.

4. Conclusion

The preliminary result of this study shows there are some differences in PAHs and NPAHs distributions in HCMC, Viet Nam and in Osaka, Japan. Total PAHs concentrations increase in rainy season in HCMC and in winter season in Osaka. The ratio of 2-NF/1-NP was high in summer in Osaka. This ratio was also high from Jan. to May. 2005 in HCMC.

The further studies on these compounds are now underway to assess their effects on environment and also human health.