Distribution and Partition of Polycyclic Aromatic Hydrocarbons (PAHs) in Water and Sediment of the Rivers in Kanazawa, Japan

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Introduction Polycyclic aromatic hydrocarbons (PAHs) are classified as persistent organic pollutants. They exist ubiquitously in various environmental components. In water environment, PAHs exhibit a complicated behavior in distribution: dissolved in water, bounded to dissolve organic matter, adsorbed to suspended particulate matter (SPM), and associated with sediments. These processes control the fate of PAHs in water environment. So, it is essential to understand how PAHs distribute in different phases of water environment.

Kanazawa City has two main rivers flowing into the Sea of Japan. As the Sea of Japan is a relative closed water environment surrounded by the Asian continent, Korea peninsula and Japanese archipelago, it is considered to be vulnerable to the anthropogenic pollution. However, we still lack systematic data of PAHs in rivers flowing into it.

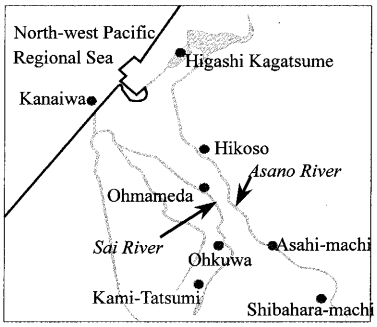

Figure 1 Map of sampling site

In an effort to clarify the fate of PAHs in the two main rivers, Asano and Sai River of Kanazawa and to estimate contribution to contaminating the Sea of Japan from these rivers, we carry out monitoring PAHs in Asano and Sai River.

Sampling and analysis Water at 4 sampling stations along each river, and surface sediment at the down stream of the rivers were collected from Asano and Sai River. The sampling locations are indicated in Fig.1. Sampling period was from Nov. 2004 to Nov. 2005 in monthly frequency except for Mar. and Apr. 2005. SPM was separated from water by filtration. 16 US-EPA PAHs except for acenaphthylene in water, SPM, and different size fraction of sediment were quantified by HPLC/Fluorescence detector.

Result and discussion

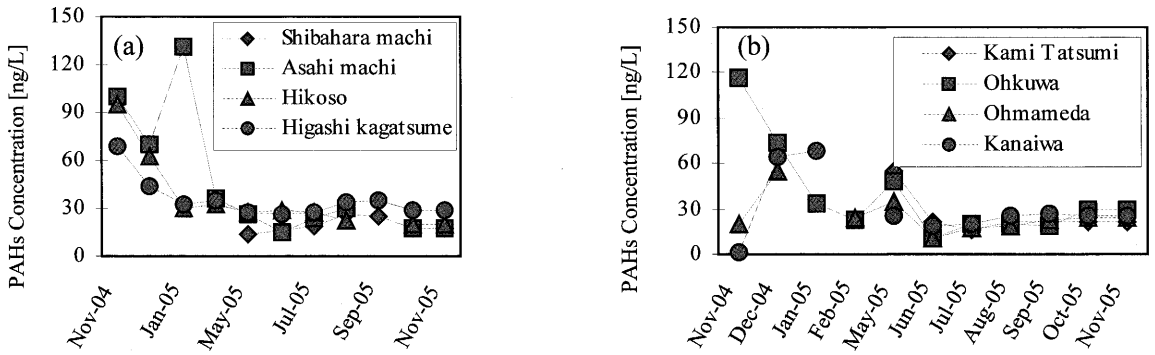

Figure 2 Variation of total 15 PAHs in water and SPM along the rivers through monitoring time, (a) Asano River; (b) Sai River

The changes in concentration of total 15 PAHs along the two rivers is shown in Fig.2.

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Concentration of total (dissolved and particulate) 15PAHs ranged from 10 to 120ng/L. In both rivers, after higher concentrations were observed from Nov. 2004 to Jan. 2005, level of PAHs became relatively stable around 30ng/L. There is nearly no difference of PAH concentrations among sampling sites in both rivers except for several points of time.

In order to interpret clearer the partition, the distribution of PAHs between dissolve water and SPM was calculated and shown in Fig.3. In Asano as well as Sai River, PAHs exhibited a trend of strong association with particulate matter. This is consistent with the fact that

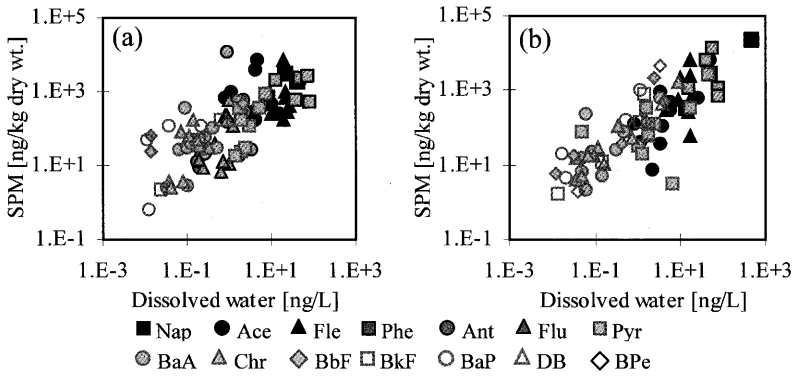

Figure 3 Distribution of PAHs between dissolved water and SPM, (a) Asano River; Sai River

PAHs prefer bounding to particle than dissolving in water. However, the low amount of SPM in water of the two rivers, most of SPM values varied around tens of mg/L, resulting in the predominance of dissolved PAHs.

Fig.4 showed the concentration of PAHs sediments. PAHs in sediment ranged from 25 to 490μg/kg. PAH levels in sediment of Sai River surpassed the level of Asano River. In both rivers, most PAHs associated with small (<75μm) size fraction.

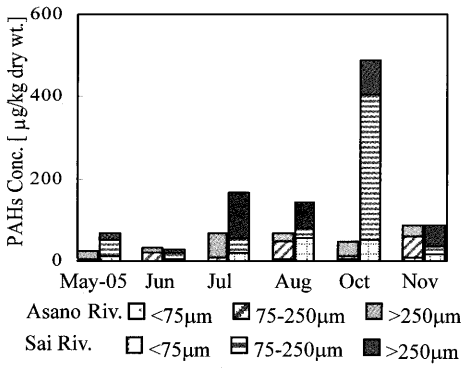

Figure 4 Concentration of total 15 PAHs sediment and contribution of different size fraction

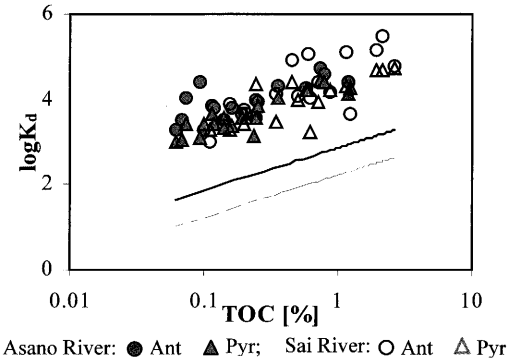

Figure 5 Plots of K_d of Ant and Pyr vs organic carbon content in sediment collected from Asano and Sai River

Conclusion Concentration of total PAHs was as low as the background level of unpolluted environment. No significant difference of PAHs concentration was observed among sampling sites. In sediments, PAHs found mostly in <75μm fraction. The observed K_d values between sediment and upper water revealed one or two orders higher than the empirical relationship reported by Mean *et al.* (1980). This suggests organic carbon was not the only factor controlling the partition.