SIZE DISTRIBUTIONS OF ATMOSPHERIC PAHS AND DIOXIN-LIKE TOXICITY AND ESTIMATION OF THEIR DEPOSITIONS TO HUMAN RESPIRATORY TRACT

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In Japan, lung cancer has the highest mortality rate among all cancers. Polycyclic aromatic hydrocarbons (PAHs) and dioxin-like compounds, which are implicated in biological activity mediated through the aromatic hydrocarbon receptor (AhR) such as P4501A1, are considered to the part of the cause. Therefore, it's necessary to characterize atmospheric PAHs and find suitable indicator substances for estimating risk. Besides, size distribution of these contaminants greatly influences inhalation exposure that leads to lung cancer. Thus, the primary objectives of this research are to demonstrate risk of atmospheric PAHs based on the unit risk values given by WHO to 22 PAHs and to find adequate indicator substances for estimating risk of total PAHs. The atmospheric particles and gases were divided into 6 aerodynamic diameter groups using Andersen air samplers in Yokohama in June and October 2002. The risk of PAHs was calculated as summation of the products of unit risks of lung cancer and concentrations of individual PAHs. The risks in June and October were 6.15×10^{-5} and 1.67×10^{-4}, respectively. It was in the same order of magnitude as that for benzene in atmosphere, which has already been regulated in Japan. Benzo[a]pyrene is considered to be an useful indicator, however, it was shown to contribute only 30.7% of the total risk in this study. Consequently, this result pointed out that a combination of several substances including dibenzo[a,h]anthracene, anthracene and dibenzo[a,e]pyrene in addition to benzo[a]pyrene should be the indicator. The secondary objectives of the study are estimating particle size contribution to the three kinds of toxicity to human respiratory tract. The three include dioxin-like toxicity, which was measured using H4IIE luciferase cell line, and concentrations of PAHs and PCDD/Fs. Based on their size distributions, their fractional depositions to human respiratory tract were calculated using reference data for regional deposition. These results showed that the <2μm size fraction contributed 82-97 % of alveoli region.