各國城市大氣懸浮微粒中多環芳香烴毒性及致變異性來源解析與健康風險

Toxicity and Mutagenic Risk Assessment of Atmospheric PM Bound Polycyclic Aromatic Hydrocarbons in Asia Cities

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Abstract

Particulate matters (PM) and the chemical components harm to human health, such as: polycyclic aromatic hydrocarbons (PAHs) are teratogenic and carcinogenicity, it can cause damage to the nerve and immune system. The objective of this study is to evaluate the toxicity and mutagenic characteristics of PAHs in PM in Asia cities. In this study, we chose the 5 urban sampling sites (Taipei, Chiang Mai, Hanoi, Ulaanbaatar and Beijing) in different countries during 2019-2023.

During the sampling periods, average concentrations of $PM_{2.5}$ measured in Taipei, Chiang Mai and Hanoi were 12.6±6.02, 132±48.6, and 63.3±11.9 μg/m^3, respectively; while the TSP concentration measured in Ulaanbaatar was 107±35.0 μg/m^3. On the other hand, the concentrations of ∑27 TEQ-BaP measured in Taipei, Chiang Mai, Hanoi and Ulaanbaatar were 2.73±3.24, 11.3±16.6, 2.81±2.64, and 18.0±8.26 ng/m^3, respectively; ∑8 MEQ-BaP concentrations were 0.08±0.04, 0.37±0.28, 0.65±0.22 and 0.90±0.39 ng/m^3, respectively. In addition, the Σ16 PAHs TEQ-BaP in those Asian cities ranged from 1.99±2.12 to 11.3±4.59 were exceed the PAHs TEQ-BaP guideline (1.0 ng/m^3).

In this study, the major anthropogenic emission sources in those five different Asian cities were significantly different. The traffic and biomass burning emission were dominant in Chiang Mai; mobile and vehicles in Hanoi; domestic coal heating in Ulaanbaatar and traffic-related in Taipei resulted in the congener distribution difference in PAHs. Moreover, the source apportionment of PAHs via PMF analysis showed that the major source was MWI in Taipei while the traffic emission in Chiang Mai (47.5%) and Hanoi (79.8%). Furthermore, the result of cancer risk in Σ27 PAHs TEQ-BaP was higher than the acceptable carcinogenic risk (1×10^{-6}-1×10^{-4}) in Chiang Mai, Ulaanbaatar, and Hanoi (6.86×10^{-4}; 1.46×10^{-4}; 1.97×10^{-3}); all of the cancer risk in Σ8 PAHs MEQ-BaP was lower than 1×10^{-4} (Chiang Mai: 3.02×10^{-5}; Ulaanbaatar: 7.19×10^{-5}; Hanoi: 4.84×10^{-5};Taipei: 6.77×10^{-6}).

關鍵字：懸浮微粒、多環芳香烴、致毒性當量濃度、致變異性當量濃度、來源解析

Keyword: PM; PAHs; PAHs-TEQBaP; PAHs-MEQBaP; Source Apportionment