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Atmospheric Polycyclic Aromatic Hydrocarbons (PAHs) in Rural and Urban of Central Taiwan

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Abstract : This study analyzed 16 atmospheric PAHs species which were controlled by USEPA and IARC. To measure the concentration of PAHs, four rural sampling sites and two urban sampling sites were selected in Central Taiwan during spring and summer. In central Taiwan, the rural sampling stations were located in the downstream of Da-An River, Da-Jang River, Wu River and Chuo-shui River. On the other hand, the urban sampling sites were located in Taichung district and close to the roadside. Ambient air samples of both vapor phase and particle phase of PAHs compounds were collected using high volume sampling trains (Analitica). The sampling media were polyurethane foam (PUF) with XAD2 and quartz fiber filters. Diagnostic ratio, Principal component analysis (PCA), Positive Matrix Factorization (PMF) models were used to evaluate the apportionment of PAHs in the atmosphere and speculate the relative contribution of various emission sources. Because of the high temperature and low wind speed, high PAHs concentration in the atmosphere was observed. The total PAHs concentration, especially in vapor phase, had significant change during summer. During the sampling periods the total PAHs concentration of atmospheric at four rural and two urban sampling sites in spring and summer were 3.70±0.40 ng/m3,3.40±0.63 ng/m3,5.22±1.24 ng/m3,7.23±0.37 ng/m3,7.46±2.36 ng/m3,6.21±0.55 ng/m3; 15.0± 0.14 ng/m3,18.8±8.05 ng/m3,20.2±8.58 ng/m3,16.1±3.75 ng/m3,29.8±10.4 ng/m3,35.3±11.8 ng/m3, respectively. In order to identify PAHs sources, we used diagnostic ratio to classify the emission sources. The potential sources were diesel combustion and gasoline combustion in spring and summer, respectively. According to the principal component analysis (PCA), the PC1 and PC2 had 23.8%, 20.4% variance and 21.3%, 17.1% variance in spring and summer, respectively. Especially high molecular weight PAHs (BaP, IND, BghiP, Flu, Phe, Flt, Pyr) were dominated in spring when low molecular weight PAHs (AcPy, Ant, Acp, Flu) because of the dominating high temperatures were dominated in the summer. Analysis by using PMF model found the sources of PAHs in spring were stationary sources (34%), vehicle emissions (24%), coal combustion (23%) and petrochemical fuel gas (19%), while in summer the emission sources were petrochemical fuel gas (34%), the natural environment of volatile organic compounds (2 9%), coal combustion (19%) and stationary sources (18%).

Keywords : PAHs, source identification, diagnostic ratio, principal component analysis, positive matrix factorization
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