Levels and Sources of PAHs in Air-borne PM$_{2.5}$ of Hefei City, China

RUOYU HU[1,2], GUIJIAN LIU[1,2]*, HONG ZHANG[1], HUAQIN XUE[1], XIN WANG[1]

[1] CAS Key Laboratory of Crust-Mantle Materials and the Environment, School of Earth and Space Sciences, University of Science and Technology of China, Hefei 230026, China

[2] State Key Laboratory of Loess and Quaternary Geology, Institute of Earth Environment, The Chinese Academy of Sciences, Xi'an 710075, Shaanxi, China

(correspondence: lgj@ustc.edu.cn)

Air-borne particulate matter plays an important role in climate and atmospheric chemistry, as it contains various harmful species that may affect human health. In particular, the particulate matter with aerodynamic diameter less than 2.5 μm (PM$_{2.5}$), attracts public attention around the world, because it is deposited throughout the human respiratory tract, causing heart and lung diseases. Polycyclic aromatic hydrocarbons (PAHs) are compounds with two or more aromatic rings, which are mainly derived from the incomplete combustion of carbon enriched materials, it can be highly enriched in PM$_{2.5}$, due to their low solubility, low reactivity and moderate vapor pressure. This work studied the concentrations and sources of PAHs in air-borne particulate matters of Hefei, China. The average daily concentration of PM$_{2.5}$ was 96.88 μg m^{-3}, the PM$_{2.5}$-bound PAH concentrations ranged from 4.92 to 71.00 ng m^{-3} (mean= 21.34 ng m^{-3}), and exhibited obvious seasonal and spatial variability. Meteorological conditions such as ambient temperature, wind speed and humidity had influences on the concentrations of PAHs. As an index for PAH carcinogenicity, the annual average concentration of benzo(a)pyrene ranged from 0.46 to 2.31 ng m^{-3}, with a mean of 1.15 ng m^{-3}. This mean was lower than the China Ambient Air Quality Standard (GB3095-2012) of 2.5 ng m^{-3}. The diagnostic ratios are all indicators of human activities, with coal combustion and motor vehicle emissions being the primary sources of PAHs in PM$_{2.5}$ of Hefei. Principal component analysis (PCA) of trace substance concentrations was used to aid in the interpretation of PAH emission sources by reducing the large number of variables to a smaller number of factors, Three factors accounted for 84.03% of the total variance of the data. The PCA suggested that combustion of coal and vehicle emissions were the main sources of PAHs in PM$_{2.5}$.