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Ambient Levels, Emission Sources and Health Effect of $PM_{2.5}$ -Bound Carbonaceous Particles and Polycyclic Aromatic Hydrocarbons in the City of Kuala Lumpur, Malaysia

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Abstract: With increasing interest in understanding the contribution of secondary organic aerosol (SOA) to particulate air pollution in urban areas, an exploratory study was carried out to determine levels of carbonaceous aerosols and polycyclic aromatic hydrocarbons (PAHs) in the city of Kuala Lumpur, Malaysia. $PM_{2.5}$ samples were collected using a high-volume sampler for 24 h in several areas in Kuala Lumpur during the north-easterly monsoon from January to March 2019. Samples were analyzed for water-soluble organic carbon (WSOC), organic carbon (OC), and elemental carbon (EC). Secondary organic carbon (SOC) in $PM_{2.5}$ was estimated. Particle-bound PAHs were analyzed using gas chromatography-flame ionization detector (GC-FID). Average concentrations of WSOC, OC, and EC were 2.73 ± 2.17 (range of 0.63–9.12) μg/m^3, 6.88 ± 4.94 (3.12–24.1) μg/m^3, and 3.68 ± 1.58 (1.33–6.82) μg/m^3, respectively, with estimated average SOC of 2.33 μg/m^3, contributing 34% to total OC. The dominance of char-EC over soot-EC suggests that $PM_{2.5}$ is influenced by biomass and coal combustion sources. The average of total PAHs was 1.74 ± 2.68 ng/m^3. Source identification methods revealed natural gas and biomass burning, and urban traffic combustion as dominant sources of PAHs in Kuala Lumpur. A deterministic health risk assessment of PAHs was conducted for several age groups, including infant, toddler, children, adolescent, and adult. Carcinogenic and non-carcinogenic risk of PAH species were well below the acceptable levels recommended by the USEPA. Backward trajectory analysis revealed north-east air mass brought pollutants to the studied areas, suggesting the north-easterly monsoon as a major contributor to increased air pollution in Kuala Lumpur. Further work is needed using long-term monitoring data to understand the origin of PAHs contributing to SOA formation and to apply source-risk apportionment to better elucidate the potential risk factors posed by the various sources in urban areas in Kuala Lumpur.

Keywords: elemental carbon; secondary organic carbon; health impact; polycyclic aromatic hydrocarbon; north-easterly monsoon

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