

Polycyclic Aromatic Hydrocarbons in Atmospheric Fine Particulate Matters in Dhaka, Bangladesh: Sources Characterization and Potential Health Impact

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This study aims to investigate the distribution and sources of 12 Polycyclic aromatic hydrocarbons (PAHs) bound to aerosol particulate matters from February, 2017 to January, 2018 in Dhaka, Bangladesh. The samples were collected on Quartz filters (Gelman, Membrane Filters, Type TISSU Quartz 2500QAT-UP, 47 mm diameter) with a low volume air sampler Envirotech (Model APM 550) at about 34 m height on the roof of Mukarram Hussain Science Building, Department of Chemistry, University of Dhaka. PAHs concentrations were measured with Gas chromatography (GC-2010 plus Gas Chromatograph, AOC-20i, Shimadzu) coupled with Flame Photometric Detector (FPD), Flame Ionization Detector (FID) and Electron Capture Detector (ECD). The average concentration of Naphthalene, Phenanthrene, Fluoranthene, Pyrene, Chrysene, Benzo (a) anthracene, Benzo (b) fluoranthene, Benzo (k) fluoranthrene, Benzo (a) pyrene, Dibenzo (a,h)anthracene, Indeno (1,2,3-cd) pyrene, Benzo (g,h,i) perylene were 23.11, 19.69, 20.34, 20.85, 18.75, 15.77, 12.22, 11.21, 14.27, 12.60, 11.97, and 16.41 $\mu\text{g m}^{-3}$, respectively. The source apportionment study was done with positive matrix factorization (PMF) model. The PMF model identified five contributory factors-sources for PAHs were Gasoline Exhaust, Diesel Exhaust, Coal and biomass burning, Industries. Air mass trajectory was analyzed by NOAA HYSPLIT model. Cancer and non-cancer risks were assessed using conventional approaches Hazard quotient (HQ) and lifetime cancer risk LCR, US EPA). For Cancer risk assessments the calculated LCR values of Naphthalene, Fluoranthene, Chrysene, Benzo (a) anthracene, Benzo (b) fluoranthene, Benzo (k) fluoranthrene, Benzo (a) pyrene, Indeno (1,2,3-cd) pyrene were 1.14×10^{-2} , 8.06×10^{-4} , 9.29×10^{-4} , 1.56×10^{-3} , 4.8×10^{-3} , 1.68×10^{-4} , 7.04×10^{-3} , 3.60×10^{-4} which were unacceptable based on the potency factor. These values are higher than the acceptable value between 1×10^{-5} to 1×10^{-6} which indicates these PAHs are carcinogenic. HQ for Naphthalene is 14.11 indicating potential harmful impact on human health. These data suggest that Naphthalene in air exceeded the safe limits and needs to be reduced.

Key words: Polycyclic aromatic hydrocarbon; Total suspended particle; Dhaka; PMF; Health risk assessment