

Polycyclic Aromatic Hydrocarbons (PAHs) heterogeneity in different PM fractions in an urban air environment of an Indo-Gangetic Plain

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Exposure to Particulate Matter (PM) bound Polycyclic Aromatic Hydrocarbons (PAHs) has adverse health effects on humans. These ubiquitous pollutants enter the lungs via inhalation and are deposited deep in the alveoli. The present study aims to quantify the effect of PAHs bound to different PM fractions on humans during January-March of 2023. PM samples for PM₁ and TSP were collected at an urban residential site in Agra, India. 16 priority PAHs were analyzed using a temperature gradient protocol in SIM mode in GC-MS. The mean TSP and PM₁ concentrations were 278.7 ± 71.5 and 80.1 ± 14.3 $\mu\text{g}/\text{m}^3$, respectively. The average concentrations of OC and EC in PM₁ were 7.5 ± 3.7 and 2.7 ± 1.3 $\mu\text{g}/\text{m}^3$, respectively, whereas OC and EC concentrations in TSP were 20.1 ± 5.2 and 4.5 ± 1.2 $\mu\text{g}/\text{m}^3$, respectively. In the TSP, the average concentration of Σ_{16} -PAHs was 1408.4 ± 113.4 ng/m^3 , while in PM₁, it was 435.4 ± 94.8 ng/m^3 . The highest mean concentration of PAHs in PM₁ was observed for BbF (51.3 ± 1.5 ng/m^3), and in TSP for IP (184.3 ± 141.4 ng/m^3). The five-ring PAHs dominate the total PAH concentration in PM₁ and TSP. The carcinogenic PAHs contributed to 85% of total PAHs in PM₁ and 63% of total PAHs in TSP. The PM₁(PAHs)/TSP(PAHs) ratio was observed highest during March (0.54) followed by January (0.32) and February (0.24). The comparatively high PM₁(PAHs)/TSP(PAHs) ratio during March was due to high temperatures and low relative humidity, influencing the partitioning of LMW-PAHs, resulting in a more substantial decrease in their concentration in PM₁. The OC/EC ratio in PM₁ (2.7 ± 1.9) and TSP (5.4 ± 1.1) suggested the influence of vehicular and coal combustion activities at the study site. The toxic equivalent factors were calculated to characterize the risk of cancer from PM₁-PAHs exposure, and BaP and DbA-dominated BaP_{eq} levels.