

Temporal variability in aerosol composition at an urban site, Varanasi in the eastern Indo-Gangetic Plain

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PM_{2.5} aerosol samples (n=31) were collected from an urban site, Varanasi (25° 28'N, 83°0' E) in the eastern Indo-Gangetic Plain during May 2015 to March 2016 using a mini-volume sampler (Leckel GmbH, Germany) at a flow rate of 200 l/hr. The PM_{2.5} samples were integrated for 7 days and were analyzed for organic and elemental carbon (OC & EC), water-soluble OC (WSOC), organic and inorganic nitrogen (ON & IN) and water-soluble inorganic species (WSIS) to study the geochemical behavior of aerosols. The mass concentration of OC and EC varies from 4.2 to 105.2 (average: 32.8) $\mu\text{g m}^{-3}$ and 1.2 to 7.0 (average: 4.6) $\mu\text{g m}^{-3}$ during the study period with total carbonaceous aerosols ($\text{TCA}=1.6*\text{OC}+\text{EC}$), on an average, accounting for $\sim 59\%$ of PM_{2.5} mass. Relatively high WSOC/OC ratio (average: 0.55 ± 0.18 ; range 0.18-0.86) indicate a significant contribution from the secondary organic aerosols at Varanasi. The concentration of ON varies from less than detection limit to 5.3 (average: 2.4) $\mu\text{g m}^{-3}$ which contribute to $\sim 12\%$ of WSOC highlighting the presence of nitro-organic compounds in aerosols at Varanasi. The average WSIS contribution to PM_{2.5} is only 17% with a strong seasonal variability (range: 4-36%). Generally, carbonaceous and inorganic aerosol concentration is higher during winter, fall and post-monsoon than those in the summer when dust aerosol contribution is significant (as high as 75% of PM_{2.5} mass). This study highlights the role of nitro-organic compounds in secondary organic aerosols which is lacking in Indian aerosols. Furthermore, these aerosol samples could be very important for the study of particle morphology and composition using scanning-electron Microscope-Energy Dispersive X-ray due to lower impaction in the mini-volume sampler.