

Geochemistry of aerosols from an urban site, Varanasi, in the Eastern Indo-Gangetic Plain

Kirpa Ram (1), Stefan Norra (2), Felix Zirzov (2), Sunita Singh (1), Manisha Mehra (1), and Sachichida Nanad Tripathi (3)

(1) Banaras Hindu University, Institute of Environment and Sustainable Development, Varanasi, India (kirpa81@gmail.com), (2) Institute of Applied Geosciences, Working Group of Environmental Mineralogy and Environmental System Analysis, Karlsruhe Institute of Technology, Karlsruhe, Germany, (3) Department of Civil Engineering, Indian Institute of Technology, Kanpur

PM_{2.5} aerosol samples were collected from an urban site, Varanasi, in the eastern Indo-Gangetic Plain on weekly basis during 19 March to 29 May 2015 (n=12), along with daily samples (n=8) during 11 to 18 March 2015 to study the geochemical and morphological features of aerosols. Samples were collected with a low volume sampler (Leckel GmbH, Germany) on the terrace of the Institute of Environment and Sustainable Development building, located in the Banaras Hindu University campus in the southern part of the city. Samples were analyzed for element concentration by Inductively Coupled Plasma Mass Spectrometry and particle morphology by Scanning Electron Microscope.

PM_{2.5} concentration ranged between 22.3 and 70.5 μgm^{-3} in daily samples, whereas those varied between 52.0 and 106 μgm^{-3} in weekly samples. Lead, potassium, aluminum, zinc and iron have conspicuously higher concentrations with Pb concentration exceeding above the annual limit of 50 ngm^{-3} in four samples. First results show a trend of corresponding concentrations of chemical elements originated from anthropogenic and geogenic sources. The biogenic particles are a minor fraction of the total particulate aerosols. The Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPPLIT) back trajectory analysis of air parcels indicate that the air mass for the low loaded days originate from eastern directions including the region of the gulf of Bengal, where as high aerosols concentrations in cases of air masses arriving from north-western direction transporting the air pollutants from the Gangetic Plain towards Varanasi.

Black carbon (BC) concentration, measured using an microaethalometer (AE-51), exhibit a strong variability (4.4 to 8.4 $\mu\text{g m}^{-3}$) in the University campus which are ~20-40% lower than those measured in the Varanasi city. The carbon content was found to be high with soot particles constituting the largest part in these samples and exist as single particle as well as attachment to other particles. The Cluster analysis shows a mixture of geogenic and anthropogenic emission sources, though their contribution could not be quantified in the present study. Thus further investigations are started with continuous aerosol sampling in Varanasi.