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# Aerosols characteristics and source apportionment at a site in Indo-Gangetic Plain

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This paper deals with atmospheric concentrations of SPM and its water soluble components, their size distribution as well as source characterizations during special aerosol. Ambient aerosol samples were collected at Dayalbagh, Agra; a site in Indo-Gangetic Plain over tropical India during Special Aerosol Land Campaign in December 2004. All samples were collected on Whatman 41 filters using High Volume Sampler ans size segregated aerosols were collected using CPS-105 size segregated impactor, extracted with deionised water, filtered through Whatman filter paper and were analyzed for major anions ($F^-$, $Cl^-$, $NO_3^-$, $SO_4^{2-}$) using Dionex Dx-500 Ion Chromatograph, major cations ($Na^+$, $K^+$, $Ca^{2+}$, $Mg^{2+}$) using Perkin Elmer – 2380 Atomic Absorption Spectrophotometer and $NH_4^+$ using Shimadzu Model – 1601 UV-Visible Spectrophotometer. The mean TSPM load during the sampling hours for the entire campaign period at Agra was 441.1$\mu$g m$^{-3}$ and it ranged between 60.47 $\mu$g m$^{-3}$and 1004.6 $\mu$g m$^{-3}$. Mean TSP value at Agra is higher than the NAAQS value for residential areas (NAAQMS/11/1999-2000 Aerosol chemical analysis revealed that $NH_4^+$ concentration is highest followed by $NO_3^-$ $SO_4^{2-}$, $Cl^-$, $K^+$, $Ca^{2+}$, $Na^+$, $Mg^{2+}$ and $F^-$. The highest concentration of $NH_4^+$ at present site may be due to near by cattle yard, and frequent use of fertilizer while low concentration of $F^-$ may be due to low level in local soil as local soil has been considered as major contributor towards particulate matter. The mass size distribution of particulate shows bimodal distribution at both the sites with one peak in the fine mode and another peak in the coarse mode. Unimodal distribution has been seen for $F^-$, $NO_3^-$ and $Na^+$ and bimodal for $K^+$, $Ca^{2+}$,

$Mg^{2+}$, $NH_4^+$, $Cl^-$, and $SO_4^{2-}$. Source interpretations to explore the origin and possible sources of ions have been done by employing correlation analysis and factor analysis on the data set through SPSS Principal Component Analysis (PCA). $Ca^{2+}$ and $Mg^{2+}$ (r = 0.70) are in very good correlation indicates their origin from similar sources. $F^-$ has significant correlation with $NO_3^-$ (r = 0.48), $SO_4^{2-}$ (r = 0.37) and $K^+$ (r = 0.35) indicates their contribution from similar sources while $Cl^-$ has significant correlation with $Na^+$ (r = 0.55) and $K^+$ (r = 50) implies their origin from similar source of almost similar strength. $NO_3^-$ has good correlation with $SO_4^{2-}$ (r = 0.52) probably due to their similar origin. $Na^+$ is in good correlation with $K^+$ (0.69). This correlation indicates that their contribution from same sources. Factor analysis was conducted on the data in an attempt to detect common variability and to identify the sources of the observed ions. Three factors have been obtained. Factor I accounts 32.1% of the total variance, includes mainly $Ca^{2+}$, $Mg^{2+}$, $Cl^-$, $K^+$, and $Na^+$and has been attributed to soil and vegetative emissions. Factor II accounts 23.0% of the total variance grouped mainly $F^-$, $NO_3^-$ and $SO_4^{2-}$ may be contributed by industrial and vehicular emissions. Factor III accounts 16.3% and includes $Na^+$ and $F^+$ and $NO_3^-$ to little extent may be attributed to intermingling.