

Carbon, Nitrogen and Sulphur isotopic characterization of fine particulates (PM_{2.5}) in ambient air over New Delhi: Implications to sources and meteorological influences

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Urban fine particulates (PM_{2.5}) are mainly composed of carbon (C), nitrogen (N) and sulphur (S) and result from secondary atmospheric processes (gas to particle conversions). Thus their stable isotopic characterization can provide important clues about their sources, transformations, transport pathways, and removal mechanism. The alarming conditions of PM_{2.5} concentrations in metro-cities like Delhi necessitate investigating the seasonal variations in major constituents with varying meteorological conditions. The PM_{2.5} particles collected from New Delhi (28.63°N, 77.17°E) between Sept 2014 and May 2015 were analysed to get elemental mass concentrations of TC, TN, TS and stable isotopes ratio $\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and $\delta^{34}\text{S}$.

It is found that mass concentration of [TC] was maximum in November probably due to the biomass burning but on the contrary, both [TN] and [TS] were maximum in January possibly due to the gas to particle conversions in cold conditions. Average $\delta^{13}\text{C}$ of ambient PM_{2.5} size particulates in post-monsoon, winter and summer is found as $-26.01 \pm 0.80\%$, $-25.73 \pm 1.39\%$ and $-24.79 \pm 2.02\%$ respectively. In post monsoon the average value of $\delta^{13}\text{C}$ of PM_{2.5} shows presence of carbonaceous material produced by C-3 biomass crop residue burnings and in winter it is due to fossil fuel combustion. $\delta^{15}\text{N}$ average value of winter ($7.32 \pm 6.61\%$) is in close agreement with $\delta^{15}\text{N}$ values of bio-fuel burning emissions (burning of animal dung, coal with average $\delta^{15}\text{N}$ values $\sim 8\%$). We observed that the $\delta^{34}\text{S}$ average value of study period is $3.63 \pm 1.53\%$ which is in close agreement with the urban pollution (coal and fossil fuel).