

Nitrogen and multiple sulfur isotopic compositions of the dissolved nitrate and sulfate in precipitation of Seoul, Korea

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Nitrogen isotope compositic values of dissovled nitrate ($\delta^{15}\text{N}_{\text{nitrate}}$) and multiple sulfur isotopic values of dissolved sulfate ($\Delta^{33}\text{S}_{\text{sulfate}}$ and $\delta^{34}\text{S}_{\text{sulfate}}$) in precipitation in Seoul, South Korea were measured. The $\delta^{15}\text{N}_{\text{nitrate}}$ values are from -1.5 ‰ to 6.5 ‰, showing negative linear relationship to 1/NO₃ ratios. The $\delta^{34}\text{S}_{\text{sulfate}}$ values are from 1.4 ‰ to 14.6 ‰. To exclude the contribution of sea salt sulfate, the non-sea salt (nss) sulfur isotopic values ($\delta^{34}\text{S}_{\text{nss}}$) were calculated. The $\delta^{34}\text{S}_{\text{nss}}$ values are from -1.1 ‰ to 8.8 ‰ with sea salt fraction less than 0.1 indicatng low contribution of sea salt sulfate to total sulfate. The $\Delta^{33}\text{S}_{\text{sulfate}}$ values, from -0.06 ‰ to 0.16 ‰, are small that is is unclear whether these values are originated from mass-independent fractionation processes. With the backward trajectory models based on HYSPLIT by NOAA which provide origin and pathways of air masses, the $\delta^{15}\text{N}_{\text{nitrate}}$ and $\delta^{34}\text{S}_{\text{sulfate}}$ values of this study suggest that these materials are considered to be emitted from anthropogenic activities such as fossil fuel combustion and car exhaust in East Asia.