Abundance and distribution of nitrogen dioxide (NO2) and particulate nitrate (pNO3-) at an urban site of Delhi-NCR

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The unprecedentedly increasing fuel combustion to fulfil the ever-increasing human population's energy demand changing the atmospheric composition, especially in terms of NO₂ and its transformational product (pNO_3^-) , which exhibit a multitude of implications for the earth system and human health. The present study reports abundance and distribution of NO₂ and pNO₃⁻ at an urban site of one of the world's most populated and polluted region (Delhi-NCR). The samples were collected from October 2017 to September 2018 at an urban site of Delhi-NCR. The annual mean (± standard error) concentrations of NO₂ and pNO_3^- were observed to be 44.56 ± 3.19 µg m⁻³ and 10.86 \pm 1.61µg m⁻³ respectively. Further, the NO₂ concentrations exhibited the transgression of National Ambient Air Quality Standards (NAAQRS) for NO₂, which is set to be 40 μ g m⁻³ for urban areas. The day/night (D/N) ratios of both NO_2 and pNO_3^- concentrations were less than unity; therefore, they showed a good congruence with the atmospheric boundary layer's diel dynamics. The seasonal mean concentrations of NO₂ were observed as post-monsoon (77.84 \pm 3.56 µg m⁻³) > winter $(39.79 \pm 2.22 \ \mu g \ m^{-3})$ > pre-monsoon $(26.78 \pm 2.44 \ \mu g \ m^{-3})$ > monsoon $(26.54 \pm 1.33 \ \mu g)$ m⁻³). Similarly, the seasonal mean concentrations of pNO_3^- were observed as post-monsoon (19.20 \pm 4.36 µg m⁻³) > winter (11.72 \pm 2.14 µg m⁻³) > pre-monsoon (8.92 \pm 1.58 µg m⁻³) > monsoon $(2.14 \pm 0.42 \ \mu g \ m^{-3})$. The higher NO₂ and pNO₃⁻ concentrations during the post-monsoon period can be attributed to the stubble burning in the Indo-Gangetic plains during this period, while their lower concentrations during the monsoon period can be attributed to the intermittent atmospheric cleansing by precipitation. The one-way ANOVA suggested that these seasonal variabilities in precursor gaseous NO₂ and pNO₃⁻ concentrations at the sampling site were statistically significant (p < 0.05). The transport paths of air masses reaching the site during sampling days were delineated by backward trajectory analysis, which showed that the NO₂ and pNO_3^{-} at this site were contributed from both local and transboundary sources.