



Ozone Precursor Measurements in Delhi, India

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Delhi often ranks among the world's most polluted cities. Despite this, there has been little work done to assess the chemical composition of its atmosphere. With regards to air quality, ambient NO_x and PM concentrations are of great concern in the city due their impact on human health, however, ambient ozone levels are often ignored. As tropospheric ozone is associated with poor health implications, its high concentrations in the city should be investigated. For increasing ozone concentrations to be understood, a detailed analysis of its photochemical precursor species, VOCs and NO_x , is required.

During May/June 2018 and October 2018, concentrations of a large range of VOCs ($\text{C}_2\text{-C}_{13}$), NO_x , CO and O_3 were continuously measured at an urban site at the Indira Gandhi Delhi Technical University for Women (IGDTUW). The site is situated to the North of Old Delhi, near the Red Fort, and is likely to be influenced by nearby heavy traffic around the Kashmiri Gate area. During the observation period, O_3 concentrations regularly breached recommended WHO 8-hour exposure limits of 60 ppb, with maximum concentrations exceeding 190 ppb in May 2018. Despite cooler temperatures, this exposure limit was also exceeded on several occasions during October 2018, with peak daily levels exceeding 100 ppb routinely.

VOC measurements were made using a robust gas chromatography technique. High concentrations of benzene were observed in both May/June and October, with campaign averages 40 % higher than the Central Pollution Control Board prescribed annual exposure limit of 1.5 ppb in May/June. October campaign averages show benzene concentrations exceed the annual prescribed value by more than three-fold. At end of October, total BTEX concentrations (benzene, toluene, ethylbenzene, xylenes) exceeded 150 ppb, coinciding with increased crop burning in areas surrounding the capital. The importance of BTEX and other reactive VOCs for in-situ photochemical ozone formation is investigated using a steady state analysis of OH reactivity. This is then explored in more detail using a box model incorporating the Master Chemical Mechanism, allowing for an ozone sensitivity study.

1. Guidelines for Measurement of Ambient Air Pollutants, Ministry of Environment & Forests, Central Pollution Control Board, 2009