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Speciation of 49 C2-C10 NMHCs during the post-harvest paddy residue fire emission period in the N.W. Indo Gangetic Plain using Thermal Desorption Gas Chromatography Flame Ionization Detection (TD-GC-FID)

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Post-harvest paddy stubble burning occurs every year in the N.W. Indo Gangetic Plain over a large area during November. This activity emits a large number of gaseous and particulate pollutants into the air and causes severe deterioration in regional air quality. In this paper, we present in-situ measurements of 49 C2-C10 NMHCS (22 alkanes, 11 alkenes and 16 aromatics) from 10-24 November 2016, many of which have been quantified for the first time anywhere in India, using Thermal Desorption Gas Chromatography Flame Ionization Detection (TD-GC-FID). The ranking in the average mixing ratios of the most abundant NMHCs was Propane (14.3 ppb) > n-Butane (8.9 ppb) > Toluene (5.7 ppb) > i-Butane (5.7 ppb) > Ethane (5.6 ppb) > i-Pentane (4.4 ppb) > Acetylene (4.1 ppb). Using inter VOC correlations, molar emission ratios and chemical tracers (CO, Propane, i-Pentane and Acetylene) we were able to constrain major emission source activities. Fire emissions were found majorly responsible for the worst pollution plumes observed during this period. Hydroxyl radical (OH) reactivity due to the measured compounds was high (∼44 s-1) with alkenes and alkynes contributing the largest fraction (72%) followed by aromatic compounds (21%). cis-2-Pentene (22%), trans-2-Pentene (17%), trans-2-Butene (15%) and cis-2-Butene (9%) were the top contributors to the measured OH reactivity. Average concentration of Acetylene, Butanes, Ethene, Pentanes and Propane are lower in Mohali as compared to Lahore, Mexico City and Karachi. Furthermore, the NMHC/Acetylene ratio for Propane, i-Butane, Toluene, Benzene and Styrene is higher than the characteristic urban emissions ratios reported in Los Angeles and Paris, due to the additional influence of post-harvest paddy residue burning emissions in the N.W. IGP.