Highlights of Volatile Organic Compound Measurements in the Megacity of Delhi During the First Phase of The Realtime Ambient Source Apportionment of Gases and Aerosol for Mitigation (RASAGAM) project

Sachin Kumar Mishra

Indian Institute of Science Education and Research Mohali, India

Author list (excluding presenting author)

Vinayak Sinha, Haseeb Hakkim, Arpit Awasthi, Sachin D. Ghude, Vijay Soni, N. Nigam, Baerbel Sinha, M. Rajeevan

Abstract

Volatile organic compounds significantly impact the atmospheric chemistry of polluted megacities. Delhi is a dynamically changing megacity and yet our knowledge of its ambient VOC composition and chemistry is limited to few studies conducted mainly in winter before 2020 (all pre-COVID). Here, using a new extended volatility range high mass resolution (10000-15000) Proton Transfer Reaction Time-of-Flight Mass Spectrometer, we measured and analyzed ambient mass spectra acquired continuously over a four-month period covering "clean" monsoon (July-September) and "polluted" post-monsoon (October-November) seasons, for the year 2022. Out of 1126 peaks, 111 VOC species were identified unambiguously. Averaged total mass concentrations reached ~260μgm^{-3} and were >4 times in the polluted season relative to the cleaner season, driven by enhanced emissions from biomass burning and reduced atmospheric ventilation (~2). Among 111, 56 were oxygenated, 10 contained nitrogen, 2 chlorine, 1 sulphur and 42 were pure hydrocarbons. VOC levels during polluted periods were significantly higher than in most developed world megacities. Methanethiol, dichlorobenzenes, C6-amides, and C9-organic acids/ esters, previously never reported in India, were detected for the first time in both clean and polluted periods. The sources were industrial for methanethiol and dichlorobenzenes, purely photochemical for the C6-amides and multiphase oxidation and partitioning for C9-organic acids. Overall, the unprecedented new information concerning VOC speciation, abundance, ambient variability and emission characteristics during contrasting seasons has advanced our understanding of the atmospheric composition of a highly polluted atmospheric environment like Delhi and sets the stage for investigating oxidation processes at play for secondary pollutant formation.

Early Career Scientist

YES, I am an early career scientist.

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