

Study of Isoprene Emissions in Biogenic and Anthropogenic Environment in Urban Atmosphere of Delhi: The Capital City of India

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Abstract : Delhi, the capital of India, is one of the most populated and polluted city among the world. In terms of air quality, Delhi's air is degrading day by day & becomes worst of any major city in the world. The role of biogenic volatile organic compounds (BVOCs) is not much studied in cities like Delhi as a culprit for degraded air quality. They not only play a critical role in rural areas but also determine the atmospheric chemistry of urban areas as well. Particularly, Isoprene (2-methyl 1,3-butadiene, C₅H₈) is the single largest emitted compound among other BVOCs globally, that influence the tropospheric ozone chemistry in urban environment as the ozone forming potential of isoprene is very high. It is mainly emitted by vegetation & a small but significant portion is also released by vehicular exhaust of petrol operated vehicles. This study investigates the spatial and temporal variations of quantitative measurements of isoprene emissions along with different traffic tracers in 2 different seasons (post-monsoon & winter) at four different locations of Delhi. For the quantification of anthropogenic and biogenic isoprene, two sites from traffic intersections (Punjabi Bagh & CRRI) and two sites from vegetative locations (JNU & Yamuna Biodiversity Park) were selected in the vicinity of isoprene emitting tree species like Ficus religiosa, Dalbergia sissoo, Eucalyptus species etc. The concentrations of traffic tracers like benzene, toluene were also determined & their robust ratios with isoprene were used to differentiate anthropogenic isoprene with biogenic portion at each site. The ozone forming potential (OFP) of all selected species along with isoprene was also estimated. For collection of intra-day samples (3 times a day) in each season, a pre-conditioned fenceline monitoring (FLM) carbopack X thermal desorption tubes were used and further analysis was done with Gas chromatography attached with mass spectrometry (GC-MS). The results of the study proposed that the ambient air isoprene is always higher in post-monsoon season as compared to winter season at all the sites because of high temperature & intense sunlight. The maximum isoprene emission flux was always observed during afternoon hours in both seasons at all sites. The maximum isoprene concentration was found to be 13.95 ppbv at Biodiversity Park during afternoon time in post monsoon season while the lower concentration was observed as low as 0.07 ppbv at the same location during morning hours in winter season. OFP of isoprene at vegetation sites is very high during post-monsoon because of high concentrations. However, OFP for other traffic tracers were high during winter seasons & at traffic locations. Furthermore, high correlation between isoprene emissions with traffic volume at traffic sites revealed that a noteworthy share of its emission also originates from road traffic.

Keywords : biogenic VOCs, isoprene emission, anthropogenic isoprene, urban vegetation

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