First PTR-TOF-MS based measurement of volatile organic compounds (VOCs) in New Delhi: Implication to regional atmospheric chemistry and climate during winter-summer transition

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Atmospheric volatile organic compounds (VOCs) are short lived compounds which play indirect but very important role in climate change as precursors of tropospheric ozone (O_3) and secondary organic aerosol (SOA). Atmospheric VOCs are oxidized by hydroxyl radical (OH) and in the presence of sun - light react with NOx ($NO+NO_2$) to produce secondary oxidant (peroxy radical), tropospheric O_3 and SOA. Therefore, VOCs affect the air quality, oxidation capacity and regional climate (Fuchs et al., 2013; Fuentes et al., 2000).

Atmospheric VOCs were measured using a Proton Transfer Reaction-Time of Flight-Mass Spectrometer (PTR-TOF-MS) at Delhi, India in the Indo-Gangatic plain (IGP) during winter to summer transition period (January –March, 2018). In IGP is the one of the most polluted regions in Asia where study of VOCs are rarely reported.

The contribution of different emission sources to oxygenated VOCs (OVOCs, e.g. methanol, acetone and acetaldehyde), biogenic VOCs (isoprene, pinene) and anthropogenic VOCs (benzene, toluene and xylene) has been investigated in the view of change in the weather condition (foggy/clear sky conditions). To study sources of OVOCs we use the three tracer Isoprene, Benzene and acetonitrile for Biogenic, vehicular and biomass burning respectively. OVOCs are primarily emitted from biogenic as well as anthropogenic activity and also produced due to oxidation of primary VOCs. We observed that the episodic enhancement of concentration of acetonitrile is due to transport from crop residue burning in the surrounding areas of Delhi the concentration of methanol shows good correlation with acetonitrile (r^2 =0.84) and acetone with isoprene (r^2 =0.83) but acetaldehyde does not show any significant relation with any of three tracers. We have estimated the slope of $\Delta T/\Delta B$ to study the impact of vehicular emission and photochemical aging. The $\Delta T/\Delta B$ slope of 2.47 suggests the vehicular exhaust is the dominant source of aromatic VOCs.

The site influenced by emissions from vehicular biomass and biogenic emission. Our result suggests development of emission inventory of VOCs is very much required to address the regional climate forcing of caused by O_3 and SOA.

Key words: IGP, SOA, OVOCs

References

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