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Ground level Ozone of non-methane volatile organic compound origin (NMVOC) - a major source of urban pollution: Study

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Researchers in India have made a first ever comprehensive measurement-based study on urban emission sources of non-methane volatile organic compounds (NMVOCs) origin at garbage dumping spots near Pirana landfill site in Ahmedabad, Gujarat. Using sophisticated measurement methods, researchers led by Lokesh Kumar Sahu at the Sardar Patel University, Vallabh Vidyanagar came out with a strategy to fight the problem of environmental impacts from organic solvents in developing countries like India.

With the collection of chemical composition data of urban NMVOCs emission sources for the first time, the study revealed that the total volume of man-made non-methane volatile organic compound emissions in urban regions of India is significantly higher than that was previously estimated. The detailed knowledge of the components of air pollution from NMVOCs from this study would help in formulating appropriate regulation policies to effectively deal with air pollution and improve human health.

It is recorded that the man-made NMVOCs represent the third-largest contribution in gaseous emission in the urban region that comes from a complex mixture of traffic, industry, solvents, waste burning, and other sources of pollution. Some of these volatile compounds are responsible for air quality deterioration and the exposure to elevated concentration can be toxic or mutagenic with serious human health implications including deleterious effects on plant and vegetation growth. The study revealed high ozone (O_3) concentrations during the spring-summer months near this major landfill site in Ahmedabad city. Volatile organic compounds (VOCs) are one of the components of air pollution containing a complex mixture of hundreds of carbon-containing gases such as alkenes, aromatic and alkane groups playing a pivotal role in the creation of ground-level ozone molecule (O_3), which increases the risks of mortality from respiratory diseases and at the same time affecting vegetation and the local climate.

Oxidation of VOCs leads to the formation of secondary organic aerosols (SOA), which are an important component of fine particulate matter or PM2.5 in cities around the world. Exposure to PM2.5 is a serious public health concern. Using statistical methods to determine concentrations of trace gases based on the direction of the airflow, the study found that ethane, ethylene, and aromatics compounds were the major components of

VOC pollution. The concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) in the downwind areas were found to be three times higher than their concentrations at the up-down sites. Whereas, concentrations of almost all NMVOCs measured at nearby sites within 800m from the landfill were higher than their concentrations at greater distances. Authors revealed that the contributions of biogenic emission from the decomposition of the landfill organic materials at nearby sites were higher than those at far downwind sites.

Pirana landfill site in Ahmedabad, Gujarat

The research team recommended long-term monitoring of common individual VOCs to track changes in each city's VOC fingerprints in response to emission control strategies. Meanwhile, short-term surveys may provide preliminary guidance as to which VOCs are most responsible for ozone and other secondary organic aerosol formation.

Led by Lokesh Kumar Sahu, the research team comprised of Nidhi Tripathi, Kashyap Patel of Physical Research Laboratory, Ahmedabad, Ravi Yadav of IITM, Pragnesh N. Dave, Sardar Patel University, and Samiksha Bajaj of Amity University, Noida.

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