

Recent study on PM2.5 in North India

Why in News?

A recent study published in the journal Nature Communications has investigated the sources and health impacts of PM2.5 in Northern India, particularly in the Indo-Gangetic Plain.

PM2.5 describes fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller.

- The study has examined PM2.5 composition and oxidative potential, a key indicator of its health risks.
- Comparative analysis shows that the oxidative potential of PM2.5 in Indian cities is among the <u>highest globally</u>, exceeding levels in Chinese and European cities by <u>up</u> <u>to five</u> times.

Oxidative potential (OP) is a metric that measures the ability of particulate matter (PM) to create reactive oxygen species (ROS).

- **Samples collected sites** Urban and roadside locations in Delhi, rural and industrial peripheries, and a suburban site in Kanpur.
- **Causes Local emission sources -** Local sources and atmospheric processes dominate particulate matter pollution.
 - $\circ\,$ In Delhi, PM2.5 is dominated by ammonium chloride and organic aerosols from vehicular emissions, residential heating, and fossil fuel oxidation
 - $\circ\,$ Outside Delhi, ammonium sulfate, ammonium nitrate, and biomass-burning-derived organic aerosols are more prominent.
- **Incomplete Combustion** PM2.5 oxidative potential is primarily influenced by organic aerosols from incomplete combustion of biomass and fossil fuels, particularly from traffic, residential sources.
 - $\circ\,$ It is observed across all locations, emphasizing that inefficient local combustion is a major contributor to PM2.5-related health risks.
- **Vehicular tailpipe emissions** Hydrocarbon-like organic aerosols originate from fresh vehicular tailpipe emissions.
 - \circ The study found that the highest average hydrocarbon-like organic aerosols concentrations (8 micrograms per metre cube) were recorded at the urban roadside site in Delhi.
- Hydrocarbon-like organic aerosols are primarily from traffic and contribute <u>up to 20%</u> of total organic aerosols mass with higher relative contributions in the warm season.

- From 20%, the contribution from traffic can increase to 40% at urban roadside.
- In all, hydrocarbon-like organic aerosols <u>constitute 50%</u> of the total fossil (coal, petrol, diesel) organic aerosols.
- **Cow dung combustion** During winter for heating and cooking contributes to coldseason primary organic aerosols.
- The cold-season primary organic aerosols are highly elevated during the night and exhibit spatially homogeneous contribution.
- Also, concentration of cold-season primary organic aerosols during cold weather are <u>up to 10 times higher</u> than during warmer weather.
- Urban oxygenated organic aerosols are affected by both fossil emissions from vehicle exhausts and non-fossil emissions from cooking, and have similar concentration levels across seasons.
- While hydrocarbon-like organic aerosols and urban oxygenated organic aerosols are especially important inside Delhi, cold-season oxygenated organic aerosol forms outside Delhi.
- The study provides crucial insights for policymakers to design effective air quality control strategies focused on reducing primary emissions from incomplete combustion.

Reference

The Hindu | Health effects of PM2.5 in northern India

