



# IIT Delhi's Study on Ultrafine Particles

## Why in News

A study titled '**Insights on the biological role of ultrafine particles of size PM<0.25: a prospective study from New Delhi**' suggested higher cytotoxicity in human lung cells because of fractions of Particulate Matter (PM) 2.5 when compared to larger particulate matters.

## Key Points

- **Methodology:** Data for the study was collected six times every month between **January and December 2017**, through a cascade impactor measurement device- for measuring fine particle size distribution- installed at IIT Delhi.
  - Airborne particles in five sizes — 2.5, 1, 0.5, 0.25 and below 0.25 micrometers ( $\mu\text{m}$ ) — were collected through the filters.
- **Findings:**
  - **Proportion of Ultrafine Particles:**
    - Particulate matter of **below 0.25 micrometers** constituted the **highest share** in the composition of PM<sub>2.5</sub> around the year as compared to particles of other sizes.
      - The PM<0.25 particles constituted over 40% of PM<sub>2.5</sub> levels during the post-monsoon season and over 30% during winters and pre-monsoon periods between March and May.
    - **A decrease in total PM 2.5 levels may not be associated with a decrease in PM<0.25 levels.**
      - This suggests that total PM<sub>2.5</sub> levels are not good indicators of PM<0.25 levels.
    - Exposure to ultrafine particles of below 0.25 micrometers was also associated with over **two-fold higher cytotoxicity** (effect of being toxic to cells), as compared to exposure to other sizes.
  - **Mass Concentration:** For PM particles of size up to 2.5  $\mu\text{m}$ , 1.0  $\mu\text{m}$ , 0.5  $\mu\text{m}$ , and <0.25 $\mu\text{m}$ , the **cumulative average mass concentration values** were found to be highest for the post-monsoon season (October-December), followed by winter (January-February).
    - High levels of **PM<sub>2.5</sub>** are recorded in Delhi every year during post-monsoon and winter months, which in the past have led authorities to declare a public health emergency on some days and close schools.
  - **Reasons:** The observed high levels of PM in the post-monsoon and winter months partially due to:
    - **Celebration of Diwali.**
    - **Agricultural residue burning** in neighbouring states of Punjab and Haryana.
    - Secondary formation of particles due to favourable meteorological conditions.

- The low temperature and high humidity during winter nights enhance the fog-smog-fog cycle and result in 2-3-fold increase in PM concentration compared to pre-monsoon and South-West monsoon season.
- **Health Impacts:** The adverse impact on health from chronic exposure to PM<sub>2.5</sub> is well established — including stroke, lung cancer, and other heart and lung related problems.
  - Health impact of different size fractions within PM<sub>2.5</sub> is not well studied yet.
- **The National Ambient Air Quality Standard (NAAQS)** has fixed a threshold for PM<sub>2.5</sub> at 60 µg/m<sup>3</sup> for 24 hours and 40 µg/m<sup>3</sup> annually, but it does not have specific policies for ultrafine particles.
  - NAAQS was notified by CPCB in 2009.
  - Pollutants covered under NAAQS are Sulphur Dioxide (SO<sub>2</sub>), Nitrogen Dioxide (NO<sub>2</sub>), Particulate Matter (PM 10, PM 2.5), Ozone (O<sub>3</sub>), Lead (Pb), Carbon Monoxide (CO), Ammonia (NH<sub>3</sub>), Benzene (C<sub>6</sub>H<sub>6</sub>), Benzo(a)Pyrene (BaP), Arsenic(As), Nickel (Ni).

## Way Forward

- Findings demonstrate a potentially important link between PM<sub><0.25</sub> levels and human health.
- Work provides novel insights for policy changes in monitoring PM, especially the need to routinely monitor PM<sub><0.25</sub>
- The necessity to start working towards establishing exposure limits for PM<sub><0.25</sub> when the total PM<sub>2.5</sub> levels are breached.

**Source: IE**

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