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## IIT Delhi's Study on Ultrafine Particles

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### Why in News

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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

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- **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<sub><0.25</sub> 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<sub><0.25</sub> levels.**

This suggests that total PM<sub>2.5</sub> levels are not good indicators of PM<sub><0.25</sub> 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 μm, 1.0 μm, 0.5 μm, and <0.25μm, 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<sub>10</sub>, PM<sub>2.5</sub>), 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

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- 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**