# Nanoparticles

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**Why is in news?** Nanoparticles in Delhi's air, a major chunk of which comes from vehicular emissions, can potentially be transported from the respiratory system to other parts of the human body, creating more chronic and acute illnesses, according to a study.

**About the study:**

The study analysed **nanoparticles (10 to 1090 nanometers in diameter)** in the city in 2021, over two periods — from April to June, and October to November.

These "very small particles" may come from **natural sources or from human activities**.

The study at the Department of Environmental Engineering, Delhi Technological University (DTU), and at the Space and Atmospheric Sciences Division, Physical Research Laboratory, Ahmedabad, was recently published in the journal 'Urban Climate.'

In **urban road environments**, nanoparticles come **mainly from the combustion process in automobiles**, adding that the concentration of these particles in urban roadside environments varies with human activity, particularly vehicular emissions.

**Nanoparticles in the road environment** can **penetrate deeper** into the respiratory system than other pollutants, the **ultrafine particles of 1 to 100 nanometers** can contribute up to 90% to the total particle number concentration.

The April to June 2021 period, which saw **Covid-related restrictions**, experienced around **31% less concentration of particles**, the study found. The recorded vehicle fleet was found to be 49% less than the normal period during this time.

In the second period, which **included Diwali**, particle concentration **increased by 35% compared to normal conditions** due to "sudden rise in firework emissions".

Researchers also found that the size of these particles varies depending on sources.

**Meteorology and other factors** can also influence concentration of these particles.

With rise in relative humidity, coagulation of these particles results in their concentration becoming high; high concentrations of these pollutants are found during peak morning and evening hours due to vehicular emissions; and higher wind speed can result in dispersion of these particles.

The PNC (particle number concentration) estimates will be useful to determine deposition of particles in the **human respiratory system** based on various inhalation rates and associated physical activities.

The particles in the nano-size range, after deposition, can potentially be transported to other parts of the body, creating more chronic and acute illnesses.

The quantitative outcomes of the present study can be used to estimate human health impacts, develop policies/standards, and initiate mitigation measures for pollution events with implications to climate change, and help move towards sustainability measures.

**Nanoparticles:**

Nanoparticles (NPs) are tiny particles and its size varies from between 1 and 100nm.

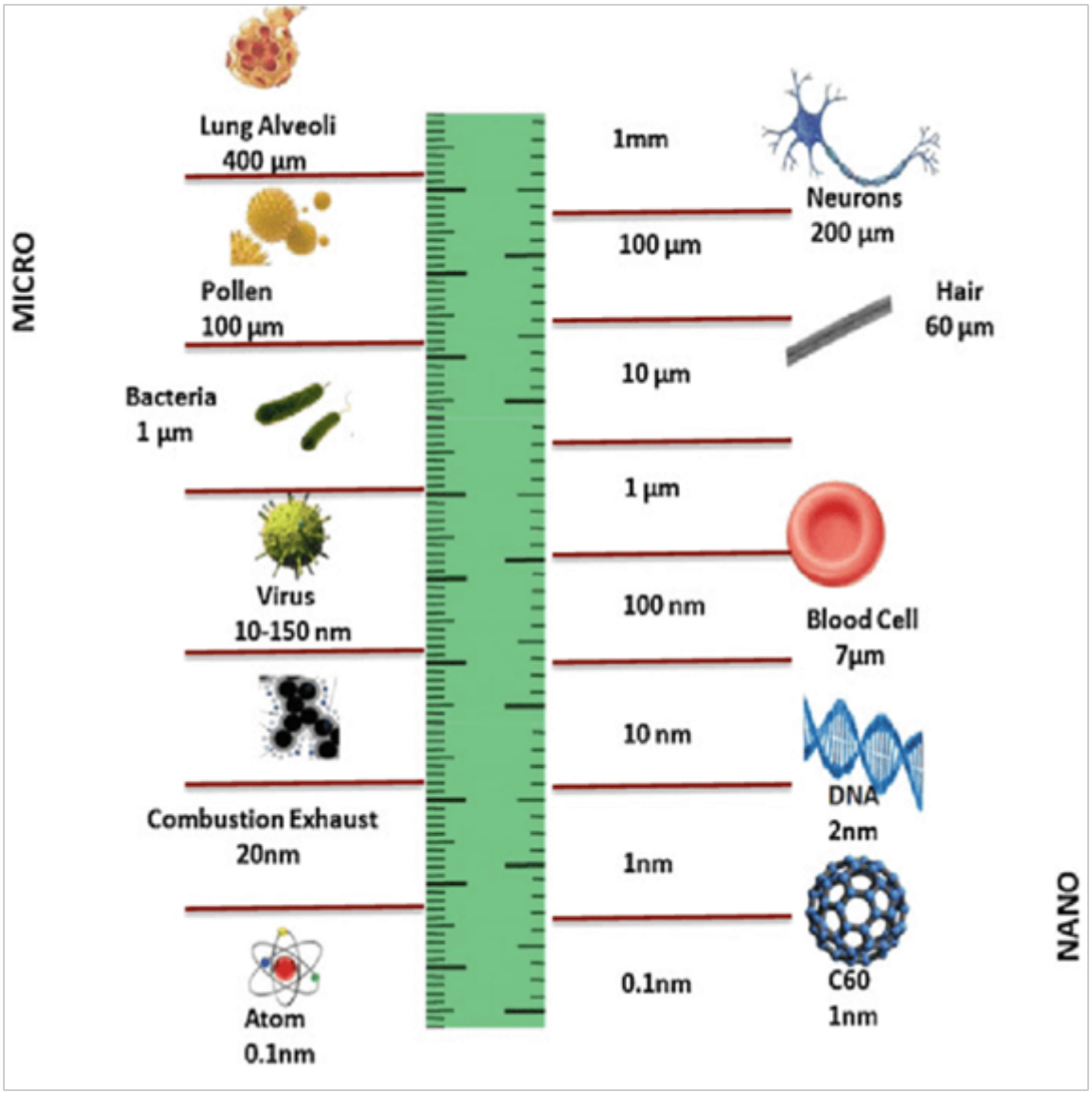
Due to their ultrafine size, they can be **suspended in the atmosphere for a long time** and can travel larger distances.

They possess **very little mass** but are many in number.

So, the current mass-based, ambient air quality regulations for particulate matter are ineffective in dealing with nanoparticle concentrations in cities.

The nanoparticles enter the environment from various sources, including natural, incidental and manufactured processes.

Nanoparticle is responsible for the formation of dust clouds, Ozone depletion, environmental hydroxyl radical concentration, and stratospheric temperature changes.



**Role of nanoparticles in air pollution:**

Unlike their larger-sized soot particles (black carbon), nanoparticles can be **activated as cloud droplets**.

High concentrations of these droplets **increase the proportion of solar radiation reflected back to space**, causing a cooling effect on climate.

**Long exposures to high concentrations** of nanoparticles cause **lung problems and cardiovascular disease**.

One of the key reasons for their negative health impact is their toxicity and large total surface area per unit mass.

This increases their potential chemical reactivity and ability to be absorbed.

They can pass deep into the respiratory system, reacting with the lung tissues and potentially entering the bloodstream.

**Infant mortality, neonatal complications and birth defects** are **likely to increase** with increasing concentrations of matter smaller than 10 µm.

As per a recent study, the number of black carbon particles that enter the mother is passed on proportionally to the baby.

**Way forward:**

Environmental risk assessments of nanoparticles during their lifecycles are essential. It is worth noting that the study of the **effects of nanoparticles on industrial and non-industrial workplaces** also is very important.

Also, the **measurement of exposures of workers in outdoor workplaces** to nanoparticles released from various sources is essential.

It is recommended that **additional information** be gathered on the **characteristics of various nanoparticles**, especially their toxicological properties, and placed in databases that can be made readily available to researchers.

**Conclusion:**

In recent years, rapid advances in nanotechnology have brought major developments in the areas of the environment, medicine, agriculture, industry, and other sciences. The nanoparticle technology has made an important contribution to the field and provided a basis for the development of nanotechnologies.

Despite the fact that the major effect of particle size on materials' toxicities has been specified in the past, the effect of particle size on the behaviour and reactivity of nanoparticles remains unclear. New issues and ideas about nanoparticles require the development of appropriate laboratory methods.