

Correlation of fine and ultrafine particle pollutions

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This work was carried out under the Net4Cities project, within which the parameters of Lung-Deposited Surface Area (LDSA) and particulate matter concentrations (PM 10 and PM 2.5) were measured, covering both ultrafine and fine particle fractions.

Particulate matter (PM) refers to a mixture of solid particles and liquid droplets suspended in air. PM 10 and PM 2.5 are classified based on their aerodynamic diameters being smaller than 10 μm and 2.5 μm , respectively. PM 2.5 mainly represents fine particles, while ultrafine particles (diameter < 0.1 μm) contribute negligibly to particle mass but dominate particle number concentration and surface area. Due to their small size, ultrafine particles can penetrate deeply into the respiratory system and are considered particularly relevant for health effects.

In addition to mass-based particle concentrations, Lung-Deposited Surface Area (LDSA) is an important exposure metric that represents the total surface area of particles deposited in the alveolar region of the lungs. LDSA is strongly influenced by ultrafine particles and is considered more closely linked to adverse health outcomes than PM mass concentrations, as particle surface area plays a key role in oxidative stress and biological interactions.

In this study, LDSA was measured using a Partector 2 instrument, while PM 2.5 and PM 10 concentrations were measured using a laser-based particulate matter sensor (SDS011, version V1.3). The PM sensor data were corrected using a calibration constant derived from experimental comparisons. Time-resolved Y–X plots were used for analysis, where LDSA or PM concentrations were plotted as a function of time to evaluate temporal behavior and correlations between surface-area-based and mass-based exposure metrics.