

Comparison of methods for determining microparticles in the air

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The primary objective of this study is to compare various methods for determining the concentration of airborne particulate matter. Currently, air pollution caused by fine particles represents one of the most pressing and significant global environmental challenges. Atmospheric air is vital for the survival of all living organisms on Earth. While technological advancement and the expansion of the transportation sector have brought many benefits, they have also led to negative consequences, such as the release of large quantities of harmful substances into the atmosphere, which adversely affect human health.

This research aims to compare instruments used for measuring aerosol concentrations and to evaluate the accuracy of a low-cost sensor in comparison to a scientific-grade instrument. The scientific-grade device employed in this study is the GRIMM Laser Aerosol Spectrometer, while the low-cost alternative, operating on a similar principle, is the Laser PM_{2.5} Sensor SDS011 (Version 1.3). The price difference between these instruments is substantial: the SDS011 sensor is readily available from online retailers (e.g., Amazon, eBay, Aliexpress) at a price ranging from 20 to 50 USD, whereas the GRIMM spectrometer costs several thousand USD and is not typically available through online marketplaces. However, used units may be found within a price range of approximately 350 to 550 USD.

For the experimental phase of the research, specific measurement sites were selected where both instruments were deployed in parallel to determine particulate matter concentrations. Based on the measurements, a calibration coefficient for the SDS011 sensor was calculated, enabling its results to be aligned more closely with those of the GRIMM spectrometer. The findings suggest that, when applying an appropriate calibration coefficient, the low-cost SDS011 sensor is capable of producing results comparable to those of the GRIMM spectrometer, both in indoor and outdoor environments.