

Evaluation of a mobile PM_{2.5} sensor and application to the measurements along the National route 1 and around Nagasaki University

*Kenta Kanegae¹, Takayuki Yamasaki², Wataru Okamoto², Yutaka Matsumi², Tomoki Nakayama¹

1. Nagasaki University, 2. Nagoya University

Short-term exposure of PM_{2.5} negatively impacts human health through respiratory disease (such as asthma and bronchitis) and cardiovascular diseases, and leads to premature death. Because PM_{2.5} is spatially and temporally variable and individuals also move in time and space, it is important to understand personal exposures of PM_{2.5} for better assessment of the health impact. We developed a palm-sized optical PM_{2.5} sensor with and Panasonic Corporation, and evaluated the performance for environmental monitoring at fixed sites [Nakayama et al. 2018]. This sensor was designed to measure PM_{2.5} mass concentrations by detecting light scattering intensities from individual aerosol particles with diameters greater than 0.3 μm . The small size, light weight, and low power consumption of the sensor are suitable for mobile personal exposure measurement. However, the sensitivity of the sensor can be change if the sensor is tilted or swung, because aerosol particles flow into the sensor via an updraft generated by a heater and flow rate may be change during tinting or swinging.

In this study, we investigate the performance of the PM_{2.5} sensor for mobile exposure measurements. The changes in the sensitivity of the sensor during tilting or swinging have been tested. Moreover, the change in the sensitivity of the sensor during walking has been investigated, by comparing the PM_{2.5} data during walking with those during standing. From the results of these tests, it was found that the sensor can be applied for mobile exposure measurements of PM_{2.5} mass concentration. We applied this sensor for the mobile measurements during walking along the National Route 1 (from Tokyo to Kyoto) for two weeks, and around Nagasaki University. The obtained PM_{2.5} data will be compared with those obtained at the surrounding ambient air monitoring stations (AEROS) and meteorological data to discuss the sources and transportation of PM_{2.5}. We believe that this research will provide useful information for applications of the compact sensor to epidemiological research of health effects of PM_{2.5}.

Acknowledgements

This work is supported by the Eco Solutions Company, Panasonic Corporation.

Reference

T. Nakayama, Y. Matsumi, K. Kawahito, Y. Watabe, Development and evaluation of a palm-sized optical PM_{2.5} sensor, *Aerosol Sci. Technol.*, 52, 2-12, doi:10.1080/02786826.2017.1375078 (2018).

Keywords: Compact PM2.5 sensor , Personal exposure, Mobile measurement