5.051 Development and evaluation of a palm-sized optical PM2.5 sensor.

Presenting Author:
Yoshifumi Watabe, Eco Solutions Company, Panasonic Corporation, Kadoma, Osaka, Japan, watabe.yoshifumi@jp.panasonic.com

Co-Authors:
Kentaro Nomura, Eco Solutions Company, Panasonic Corporation, Kadoma, Osaka, Japan
Tomoki Nakayama, Graduate School of Fisheries and Environmental Sciences, Nagasaki University, Nagasaki, Japan
Yutaka Matsumi, ISEE, Nagoya University, Nagoya, Japan

Abstract:

A new palm-sized optical PM2.5 sensor has been developed and its performance evaluated. The PM2.5 mass concentration was calculated from the distribution of light scattering intensity by considering the relationship between scattering intensity and particle size. The results of laboratory tests suggested that the sensor can detect particles with diameters as small as 0.3 mm and can measure PM2.5 mass concentrations as high as 600 mg/m3. Year-round ambient observations were conducted at four urban and suburban sites in Fukuoka, Kadoma, Kasugai, and Tokyo, Japan. Daily averaged PM2.5 mass concentration data from our sensors were in good agreement with corresponding data from the collocated standard instrument at the Kadoma site, with slopes of 1.07–1.16 and correlation coefficients (R) of 0.90–0.91, and with those of the nearest observatories of the Ministry of the Environment of Japan, at 1.7–4.1 km away from our observation sites, with slopes of 0.97–1.23 and R of 0.89–0.95. Slightly greater slopes were observed in winter than in summer, except at Tokyo, which was possibly due to the photochemical formation of relatively small secondary particles. Under high relative humidity conditions (>70%), the sensor has a tendency to overestimate the PM2.5 mass concentrations compared to those measured by the standard instruments, except at Fukuoka, which is probably due to the hygroscopic growth of particles. This study demonstrates that the sensor can provide reasonable PM2.5 mass concentration data in urban and suburban environments and is applicable to studies on the environmental and health effects of PM2.5.