ABSTRACT

Low-cost sensors $LCSPM_{2.5}$ ($LCSPM_{2.5}$) have the advantages of which are affordable prices, low power consumption, and small and compact size. However, $LCSPM_{2.5}$ limitations on the resolution and accuracy of the main measuring devices. Therefore, laboratory testing is needed to identify $LCSPM_{2.5}$ performance. The test is carried out by calibrating the sensor to the source of poly and mono disperse particles produced from the nebulizer (flow rate 2.6 L/min). Polydisperse particles were produced from solutions NaCl, NH_4NO_3, and $(NH_4)_2SO_4$ (99.5%, 95.0%, and 99.5%; Merck KGaA Corp.). The results of comparison of $LCSPM_{2.5}$ data against other similar sensors obtained ±9 $\mu g/m^3$ error (R^2=±0.98) in the concentration range of 0-500 $\mu g/m^3$. Then the addition of a long differential mobility analyzer (LDMA) was added to produce 0-450 nm monodisperse particles in the sensor testing with GRIMM and condensation particle counters (CPC, TSI 3025 models). The results show double the sensor readings from the GRIMM data. This is because about 95% of the particle size is ≤300 nm. In testing sensors with monodisperse particles (sizes 300, 400, and 500 nm). $LCSPM_{2.5}$ concentration readings with the same data trend but overestimate the 300 nm particle. Because the wavelength of 630-680 nm used produces scattering which all fall into the Mie regime which is supposed to be partikel ≤300 nm particles approaching the Rayleigh regime. Increasing the particle size to 400 nm and 500 nm shows relatively similar results by entering an error value of ±10 $\mu g/m^3$. The effect of density and refractive index (m) on the solution (NaCl, 2.16 g/cm^3 with m=1.45) and $(NH_4)_2SO_4$, 1.77 g/cm^3 with m=1.44) gives an underestimate response to low and medium concentrations, compared to solutions (NH_4NO_3, 1.72 g/cm3 with m=1.41) gave almost the same response. $LCSPM_{2.5}$ readings that use signals from a group of particles cause when the high sensor concentration gets higher or overestimates.

Keywords: *Diffusion Dryer, Calibration, Low-Cost Sensor $PM_{2.5}$, Nebulizer.*