Low-cost Optical Sensors and their Applicability for Measurement of Ambient PMx

Wladyslaw W. Szymanski

Faculty of Physics, Aerosol Physics and Environmental Physics Group

University of Vienna, Austria

E-mail: w.szym@univie.ac.at

Abstract: Instruments that rely on the elastic scattering of light to measure airborne particle size distributions have already proven their worth in aerosol research, particularly in the size range of about 0.1–10μm. Applying this principle, the low-cost, compact optical particle sensors have the potential to provide direct, real-time data of size-resolved particulate matter (PM) concentrations and be helpful in air quality studies and pollution monitoring. The trade-off when using low-cost sensors is that currently their accuracy and sensitivity is not well-documented, if at all. Consequently, low-cost sensors for particulate air pollutants need to be carefully characterized to ensure that they meet the specific requirements of the intended application. Principles of aerosol photometers and single optical particle counters will be discussed indicating the drawbacks which are connected with miniaturization and cost-cuts of optical sensors. Main problems are: material dependence, lower size sensitivity, accuracy, calibration and performance stability, hence the data repeatability for varying ambient conditions such as temperature, RH and also measuring protocol. Low-cost optical sensors may be appropriate for some applications, such as complementing regular air quality measurements. However, if optical low-cost sensors are to be used for accurate particle exposure measurements or for compliance monitoring in the future, laborious studies are still needed. What is important in that context is the fact that due to the broad availability and bargain prices for those measuring devices the engagement of the public and community interest groups must be scientifically confronted and guided. Furthermore, mirrored by the exponential sales (and publication numbers) regarding low-cost optical particle sensors, the urgent need for harmonization and suggestions for standardization and common terminology will be addressed.

Keywords: *Optical Photometry, SingleParticle Counting, Refractive Index, Calibration*