5.3. PERFORMANCE OF COMMERCIAL LOW-COST DEVICES TO ASSESS INDOOR PARTICULATE MATTER IN NURSERY AND PRIMARY SCHOOLS

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Indoor air quality (IAQ) has gained an increasing concern worldwide (Kumar et al., 2016). In this sense, a special attention has been given to particulate matter (PM), because it has been recognized as a priority pollutant and also due to its potential to induce various adverse effects to human health (pulmonary diseases, asthma and other respiratory problems) (Liu et al., 2018; WHO, 2010). Children constitute a particular group of sensitive population to indoor air pollution health effects. Therefore, schools are a crucial study environment, because, apart from home, children spend there a great part of their day. Commercially low-cost air pollution technologies emerged as a promising revolutionary advance in indoor PM monitoring, and consequently, as a tool to improve citizen's health, quality of life and well-being (Rai et al., 2017). Thus, the main aim of this work was to evaluate the performance of three PM commercially available low-cost devices for evaluation of IAQ in one nursery and primary school.

Three PM commercially available low-cost devices were selected to monitor IAQ continuously in school environments in accordance with major criteria: (i) cost less than 500 EUR; (ii) range measurement and limit of detection; and (iii) data acquisition, storage and privacy. Thus, during more than one month (from June to July 2019), uRADMonitor A3, AirVisual Pro and PurpleAir SD were deployed with a reference instrument (TSI DustTrak DRX 8534 Aerosol Monitor) in five different rooms for different age groups (varying between 0 and 10 years old) and one lunchroom from one nursery and primary school located in Porto district influenced by traffic emissions. Three fractions of PM, namely PM_1, $PM_{2.5}$ and PM_{10}, were measured by all commercial low-cost devices. Indoor hourly mean concentrations and daily mean profiles were performed, as well as a descriptive statistic. To evaluate low-cost devices' performance, a correlation assessment was performed among the commercial low-cost devices and with the reference instrument. Moreover, PM low-cost devices were calibrated using reference instrument measurements resorting to univariate linear regression models.

Daily mean profiles presented an expectable behaviour with similar profiles for all three studied fractions PM_1, $PM_{2.5}$ and PM_{10}, which were characterized by higher concentrations during occupancy periods. In general, for all measurement period, inter-correlation between all low-cost devices were high (R^2 = 0.55 – 0.96). In turn, the correlation between all three PM low-cost devices and the reference instrument were not so high and varying from room to room. Additionally, higher correlations were observed for background periods than for occupancy ones. Regression analyses showed that for finer particles uRad and PurpleAir (R^2 = 0.55) presented better correlation than AirVisual (R^2 =0.49), while for PM_{10} the opposite occurred (R^2 = 0.22 for uRad, R^2 = 0.24 for PurpleAir and R^2 = 0.42 for AirVisual). Generally, univariate linear regression allowed to slightly improving the correlations between the studied PM low-cost devices and reference instrument. These results showed the ability of low-cost sensor technology being used as a tool for air quality management for community in schools, however, more and deeper studies are recommended.

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