Use of Miniaturized Aerosol Instruments on Indoor Air

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Use of miniaturized aerosol instruments on indoor airborne particles

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The objective of this study was to develop and test aerosol measurement methodology, which can be used in populated residences in order to provide epidemiologic studies with detailed exposure data for airborne particles. In this study it was of particular importance to measure the whole size range of particles, from ~10 nm to 10 µm.

To be able to measure during a week in a residence, the instrumentation must not create any annoyance or induce any abnormal behaviour among the people that live in the residence. Laboratory standard aerosol instruments, such as aerosol time-of-flight and particle mobility spectrometers are therefore not suitable for the task because of their size, noise level, odour of butanol and maintenance requirements. Instead miniaturized instruments were used. IAQ 3016[1] particle counter (Lighthouse, US), which counts and size particles in 6 size bins between 0.3 and 10µm, was used. For the size range 10 to 100nm, MiniDiSC[2] (University of Applied Sciences, CH) were used. Black carbon concentration was monitored with a microAeth AE51[3] (Magee Scientific, US.

Together with the instruments a shelf was brought to the sites. The shelf was placed as close to the kitchen as possible, with the nanomonitors on the top shelf at a height of 1.4 m and the optical spectrometer next to the black carbon monitor at a height of 1 m. The instruments were let running for a week at each site and the residents were instructed to keep track of their activities in logbooks,

An example of the measurements in one residence with 12 hours of data is shown in figure 1 to 3. Data from the IAQ 3016 are displayed as PM2.5 and PM10. During the period, the residents held a party with 30 guests. According to the logbook the residents started preparing the dinner 12:30 in the oven and at 16:30 the guests arrived. During the party several candles were lit. As seen in the diagrams the data sets correlate with the logbook. The emission of particles from the oven is clearly seen in figure 1and 2 at 13:00. At the time the guests arrived a steep increase of both PM10 and PM2.5 was measured. This could be caused by the lighting of the candles which yields soot. The black carbon monitor supports this hypothesis. Throughout the evening the nanoparticle number concentration was kept high because of the candles as seen in figure 1, while the PM10 and PM2.5 decreases (figure 2).

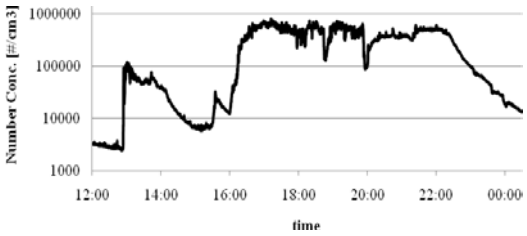

Figure 1. Nanoparticle number concentration, MiniDiSC readout.

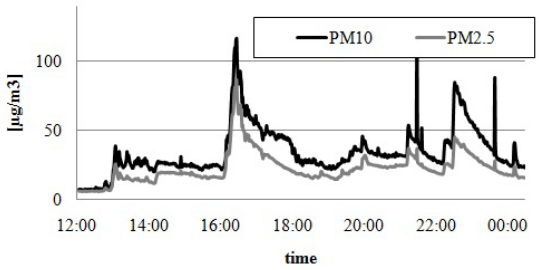

Figure 2. PM10 and PM2.5, IAQ 3016 readout.

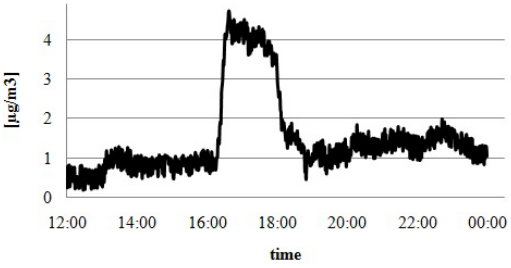

Figure 3. Black carbon, microAeth readout.

The measurement methodology with simplified instruments in combination with logbooks makes it possible to perform detailed investigation of indoor airborne particles.

[1]http://www.golighthouse.com
[2]http://www.fhnw.ch/technik/iast
[3]http://mageesci.com