Preview on Nanoparticle Monitors

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Preview on Nanoparticle Monitors

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MiniDiSC (University of Applied Sciences, Windisch, CH), NanoCheck (Grimm Aerosol) and NanoTracer (Philips Research) are new, light weight, battery powered aerosol instruments that are based on electrical measurement techniques. The MiniDiSC is a handheld version of the DiSC (Fierz et al. 2007). The handheld NanoTracer (Marra 2008) and the portable NanoCheck (Schneider 2009) are based on similar measuring principle. These instruments are developed for measuring nanoparticles and are able give fair estimates on number concentration and particle mean diameter. In this study the instruments were tested on candle smoke.

The NanoTracer and the MiniDiSC was at the time of the study in the final stages of development. The results are, therefore, not necessary representative for the final products.

The three instruments were calibrated by the manufacturers with salt aerosols. During the tests the instruments where run in parallel with a uCPC (model 3025, TSI) and an SMPS-system consisting of a Vienna DMA and a 3760A CPC (TSI). The candle smoke was generated by ten candles and the smoke was then led to a $22m^3$ chamber were the instruments were placed. After reaching a mass concentration of $200\mu g/m^3$ the candles were extinguished. The chamber was continuously ventilated with particle free at an air exchange ratio of $5h^{-1}$.

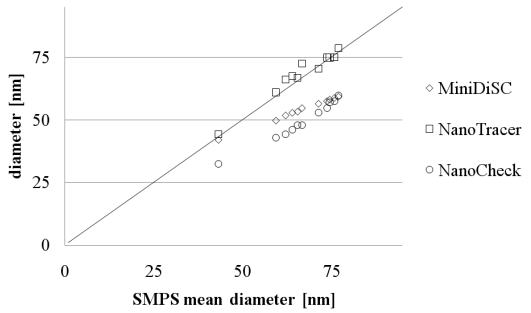

Figure 1. Diameter correlation between SMPS system and the studied instruments. 60s average.

As shown in figure 1, the NanoTracer correlates well with the particle diameter as measured with SMPS (average of 2.5% error). The MiniDiSC and the NanoCheck underestimated the diameter with an average of 19% and 25% respectively. On the other hand as indicated in figure 2, the average error in the NanoCheck particle number concentration is less than 2%, while NanoTracer and the MiniDiSC overestimated the number concentration by an average of 34% and 45% respectively.

Neither of the instruments was calibrated for the aerosol used in this study and errors are expected and since the errors show fairly monotonic relationship, proper calibration would suppress these errors.

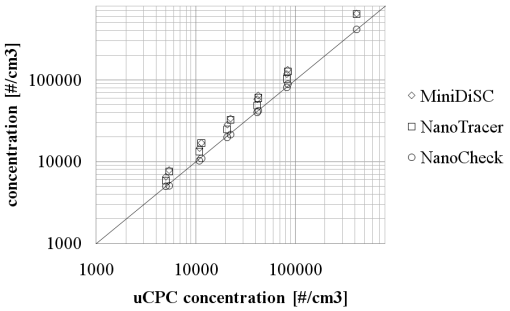

Figure 2. Concentration correlation between uCPC and the studied instruments. 60s average. (At 400 000 $\#/cm^3$ the SMPS was used as reference.)

The SMPS system is the most frequently used instrument for nanoparticles, but the complexity makes field work challenging. Although the instruments in this study provide less accurate data, the simplicity and the battery powered design give them potential to be used extensively in field work.

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