The Spanish network on environmental DMAs: the 2012 SMPS+UFP intercomparison campaign and study on particle losses in dryers

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The Spanish network on environmental DMAs (Red Española de DMAs Ambientales, REDMAAS) is currently formed by six groups involved in the measurement of atmospheric particle size distributions by means of Differential Mobility Analyzers (DMAs). These groups are: IUMA-UDC, IDÆA-CSIC, INTA, IARC-AEMET, University of Granada and CIEMAT. The network has been working during the period 2010-2012 (Gómez-Moreno et al., 2011 & 2012). The REDMAAS has as main objective the cooperation between the groups to solve common problems and to optimize their facilities and protocols. The main activities developed in the network include: DMA calibration; CPC, SMPS and UFP intercomparison; measurement quality control program; losses in sampling lines; support for the radioactive facility license; webpage; and new DMA applications. In this work, the main results obtained during the 2012 SMPS+UFP intercomparison campaign, including the DMA calibrations and a study on particle losses in dryers are shown.

The field intercomparison exercise was performed during November 2012 in the INTA facilities (El Arenosillo, Huelva). There were 5 complete SMPS systems, an UFP and two additional CPCs. After calibrating all the flow rates, a CPC intercomparison was performed obtaining good results. The results for the DMA calibration was better than the previous campaigns, with a maximum deviation of 2% for 80 nm latex particles and only one SMPS above 5% for 190 nm latex particles. The SMPS intercomparison showed similar results to those obtained in the previous years (Gómez-Moreno et al., 2011 & 2012). The UFP showed good results when the adequate correction matrix was used.

One of the problems to study was the particle losses in the lines, especially in the dryers because of the few results published. The setup was as followed: the sampled air went through a dryer after which there was a flow splitter. Two SMPSs in parallel measured the particle size distribution, the first of them had the testing dryer and the second didn't have any. These two SMPSs were selected because they previously had shown to measure the same distributions. The pipes lengths from the splitter to the SMPS were the same for both of them, so the differences in the measurements were caused by the particle deposition in the dryer. Six dryers (5 Permapure Nafion dryers SS12" and 1 dryer SS24") were tested. An example of the results can be found in figure 1

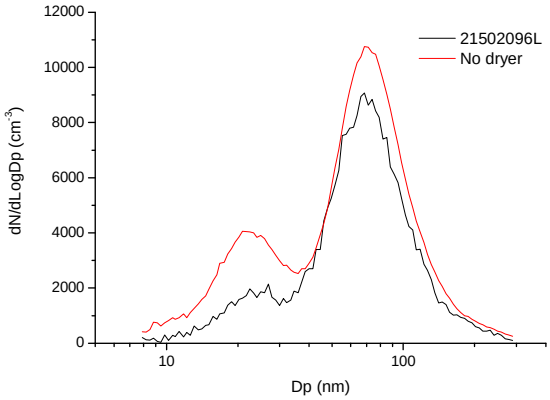

Figure 1. Comparison of a dry aerosol (flow rate: 1 lpm) measured with and without dryer (Nafion SS24"). The difference between the two measurements is the particle deposition in the dryer.

A comparison with theoretical deposition has been done. To calculate diffusional particle losses in the dryers, Wiedensohler et al (2012) recommended to consider the Permapure Nafion dryers SS12" and SS24" as pipes with equivalent lengths of 1.25 and 2.5 m respectively. These same equivalent lengths have been used to consider other different mechanisms for deposition.

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