

## Reply to Dr. Paul Zieger

Dear Dr. Zieger,

Thank you so much for your comments, and we totally agree that lab calibration and verification of this method using the substances with known hygroscopic parameters is critical important. We proposed a potential design for this type of test, but it could not be realized in our lab at this time due to limited resources. To made up this to some extent, we add more detailed discussion in the text with all reference being cited and including the proposed instruments set-up, as

“It is important to note that the derived  $K_{OA}$  values in this study were not continuous, as we could only obtain them under high relative humidity (RH) conditions (85% to 90%). Additionally, our current inability to maintain aerosol under such high RH conditions limited the laboratory calibration and verification of this method using substances with known hygroscopic parameters (Fierz-Schmidhauser, et al., 2010; Zieger et al., 2013; Han et al., 2022), even though this method is theoretically feasible. To resolve this issue, one possible update of this system could be adding a humidifier system to the pDR to get wet aerosol with RH between 85% to 95%, and the possible set-up for humidifier system could include a Perma Pure MH-series humidifier, water pumps and tanks (red dash box in Figure 2). This will make this system more be similar to the widely used humidified nephelometer system (Guo, et al., 2015; Burgos et al., 2019, Fierz-Schmidhauser et al., 2010; Kuang et al., 2017,2018,2020, 2021).

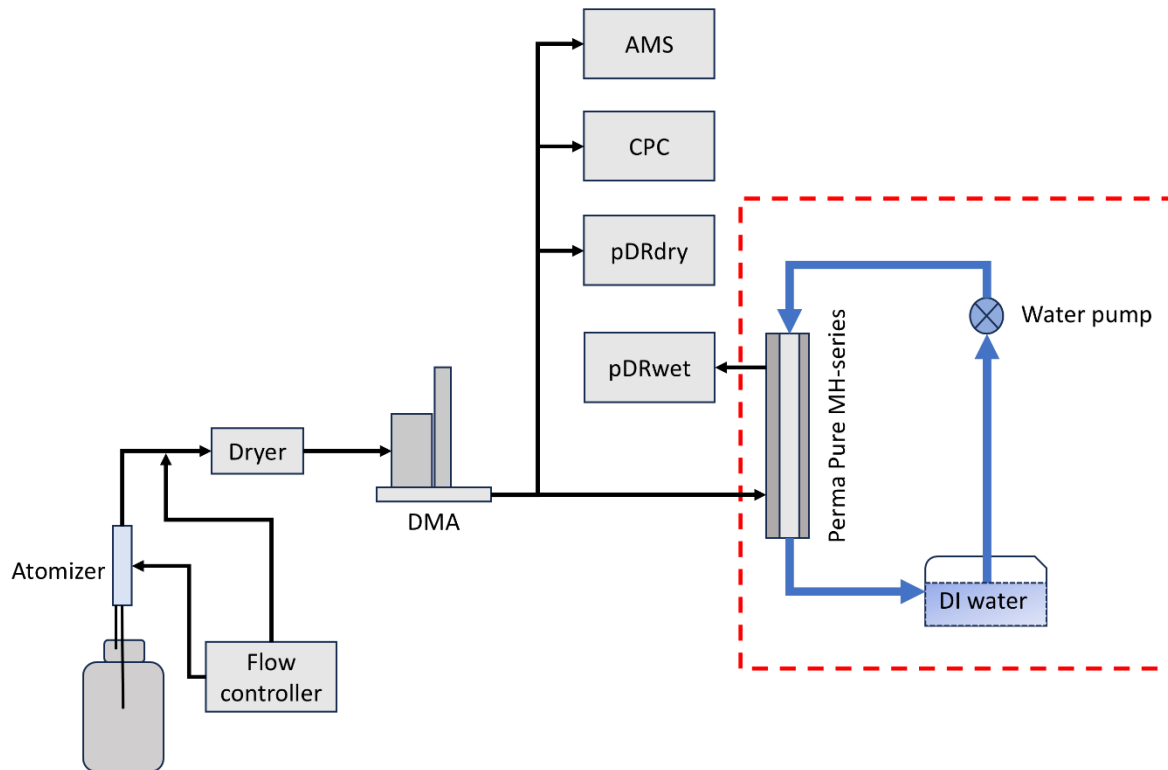


Figure 2. proposed instrument setup for lab calibration

The proposed instrument setup for lab calibration will include an atomizer to produce aerosol, which will be dried through the dryer. Then, the Differential Mobility Analyzer (DMA) will pick up different size of aerosols, with one of branch aerosol flow to the humidifier system to get wet and then to pDR<sub>wet</sub>, and another three branches of aerosol flows to pDR<sub>dry</sub>, AMS, and condensation particle counter (CPC). The substances/aerosol for testing will include the organic aerosols with known hygroscopic parameter (Han et al., 2022), the inorganic aerosols (i.e., (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>, Fierz-Schmidhauser et al., 2010), as well as their mixing solutions of organic and inorganic. Due to limited resources, this proposed instrument setup is not feasible at this moment, and the lab calibration is not included in this study. However, we hope this will inspire other research groups with this set-up to conduct these lab tests to better quantify the uncertainty of this method for pDRs. Given that the pDR is a type of single-wavelength nephelometric monitor, it's logical to consider that other brands commonly used low-cost nephelometric monitors (e.g., Purple Air, Plantower PMS series) might offer similar capabilities, and related lab test would be also highly recommended.” **(Line 236-257 for the revised version). Thank you so much for your understanding.**