Novel, all-in-one apparatus for stable and reproducible generation of atmospherically relevant aerosols using simulated atmospheric aging

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There is a need for well-defined reference aerosols generated in the laboratory, simulating properties of real ambient aerosols while being stable and reproducible. Ambient aerosols are mixtures of fresh and aged products. Atmospheric photochemical aging influences both physical and chemical properties and should be considered for complex studies as well as everyday applications. Nevertheless, there is no commercial aerosol generator that can mimic this complexity. A possibility is to combine a source of fresh soot particles, e.g. a miniCAST burner, an oxidation flow reactor (OFR) and a carefully controlled dosing system to produce high concentrations (i.e., tens of mg/m^3) of fresh and aged carbonaceous particles in a stable and reproducible manner [1].

Within the framework of the EMPIR AeroTox project, we have gone a step further toward the miniaturization and automation of the production of ambient-like carbonaceous aerosols. We developed a novel portable aerosol generator equipped with a humidifier, a precursor dosing system and a redesigned micro smog chamber (MSC)[2]. This instrument can produce pure secondary organic matter (SOM) particles or, used in combination with a standard soot generator, particles consisting of a soot core coated with SOM. The physical and chemical properties of the generated particles can be tuned in a simple manner by selecting target values for parameters, such as precursor concentration, humidity, and UV light intensity. This development allows, for the first time, to simulate in the laboratory a wide range of atmospherically relevant carbonaceous aerosols with the use of a single portable instrument. Applications include instrument calibration, filter testing, and health and climate studies. The 18HLT02 AeroTox project has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme

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