Supporting material

S1 The A-ECO oven system

Figure S1 shows a schematic of the oven system, with the inner part made of quartz glass, surrounded by heating wire. The front oven (right) can be opened and a quartz boat containing the filter sample can be inserted. The back oven shown here in cross section is filled with catalyst. The two ovens are separated by a narrowing in the quartz tube, surrounded by insulating material. This prevents a strong influence of the high temperature of the catalyst oven on the temperature of oven 1.

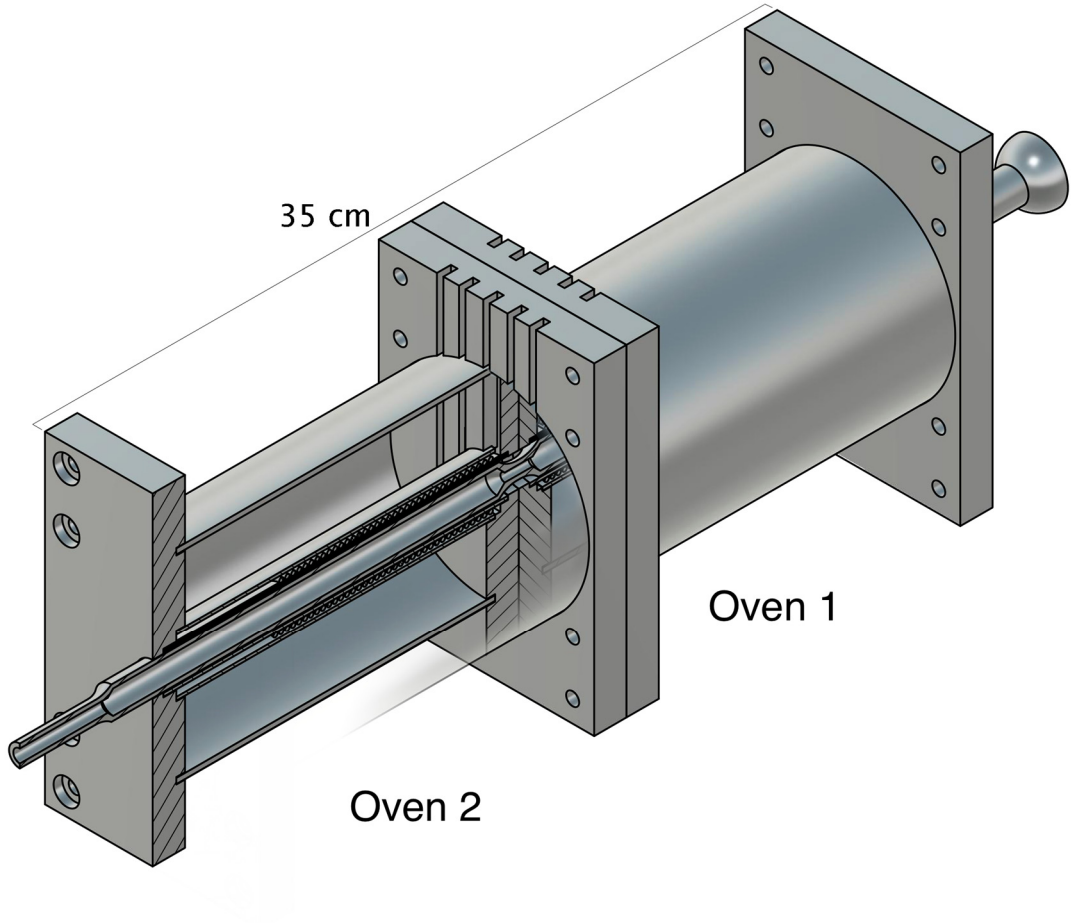

Fig. S1: A schematic drawing of the oven system

Figure S2 shows that the temperature distribution of the front oven has a region of > 5 cm, where the temperature is constant for all setpoint temperatures. At higher setpoints, the temperature shows a decrease between the front and back oven, but the temperature rises quickly again inside the back oven.

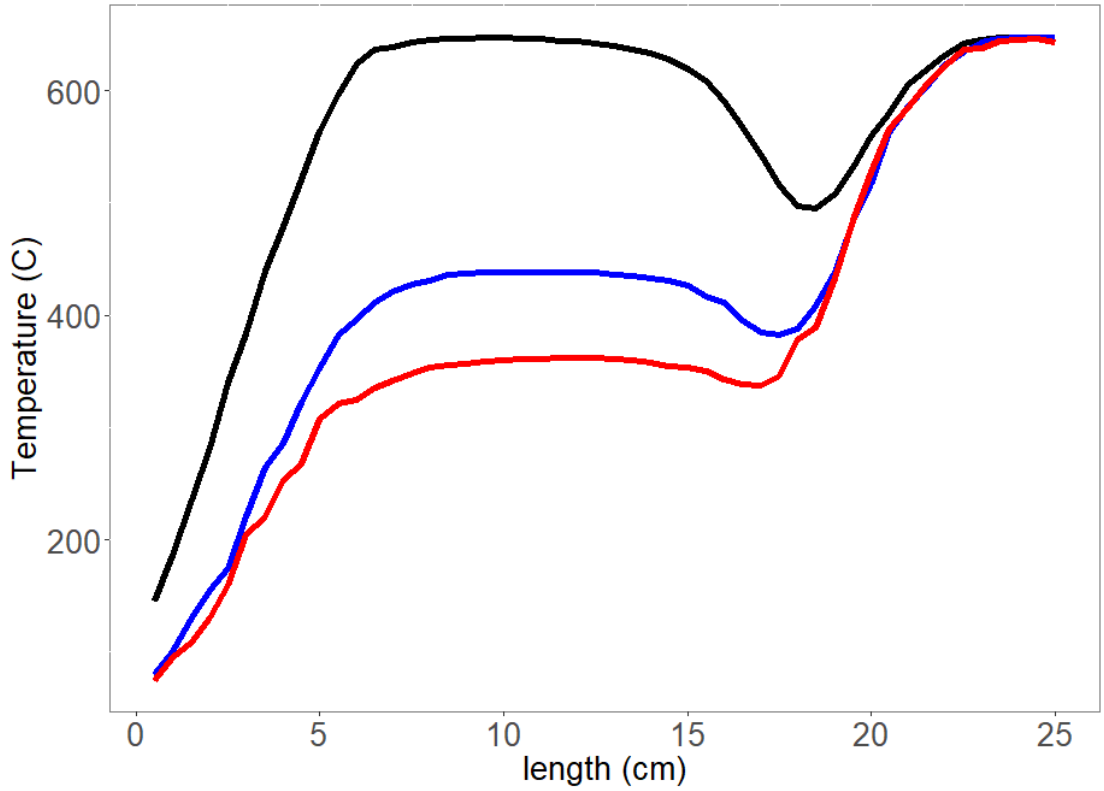

Fig. S2: The temperature distribution of the ovens for various temperature setpoints of the from oven used in the 2-step protocol (black: setpoint 650 °C, blue: setpoint 450 °C, red setpoint 375 °C). The x-axis gives the distance of the thermocouple from the start of the from oven (x = 0).

S2 Calibration of the Vaisala IRGA sensor

A calibration curve is made by comparing the Vaisala IRGA sensor to a Licor NDIR detector, which is known to be linear. A defined, constant concentration of CO_2 in oxygen carrier gas is measured by both the Vaisala and the LICOR, using the steup shown in Figure S3.

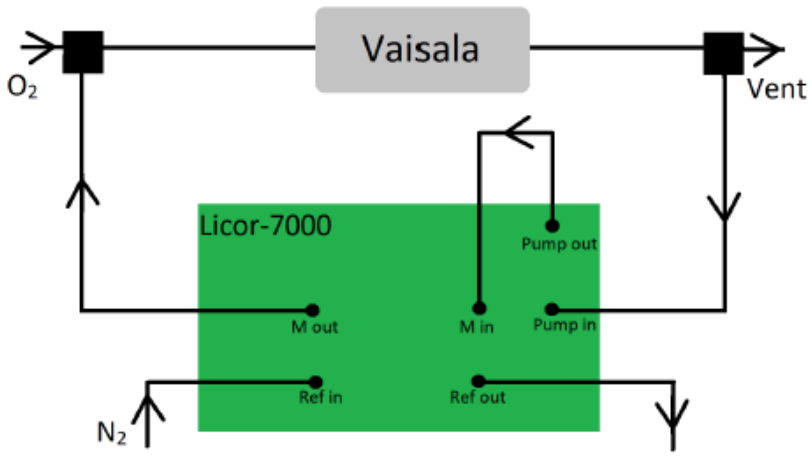

Figure S3: The setup for calibrating the Vaisala sensor against the Licor NDIR detector

A constant flow of O_2 carrier gas is circulated between the Licor and the Vaisala sensor in a closed loop. A pulse pure CO_2 is introduced into the system and diluted with oxygen by opening the oxygen supply and opening the vent. After the CO_2 concentration drops to the desired level, the valves are closed again. The LICOR has an internal pump that circulates the gas through the setup. After the CO_2 concentration has equilibrated throughout the circuit, the concentration recorded by both devices is logged. This is for several dilution steps to cover the whole CO_2 concentration range of the Vaisala sensor. Figure S4 shows the resulting calibration curve. For small CO_2 concentrations the Vaisala sensor shows a slight underestimate and for larger CO_2 concentrations a slight overestimate. Figure S5 shows a typical CO_2 peak resulting from the combustion of an aerosol sample measured both by the Vaisala sensor and the LICOR. The LICOR sensor was connected to the vent of the A-CEO system and therefore measured downstream of the Vaisala sensor, as can be seen by the small time shift in the detected CO_2 peak. The red line corresponds to the raw Vaisala CO_2 concentrations and the blue line the concentrations after calibration. Peak integration of the calibrated concentration curve of the Vaisala sensor yields virtually the same CO_2 mass as integration of the LICOR peak.

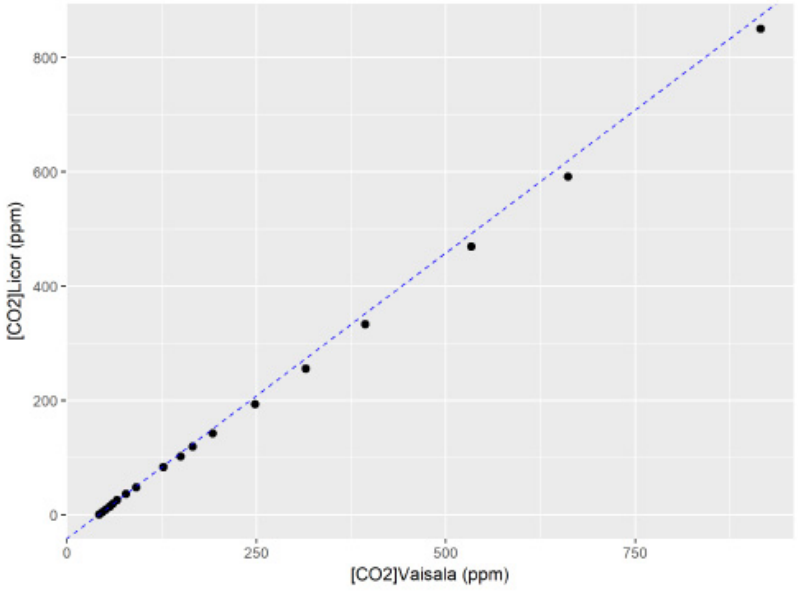

Figure S4: The concentration measured with the LICOR NDIR detector as a function of the concentration measured with the Vaisala sensor.

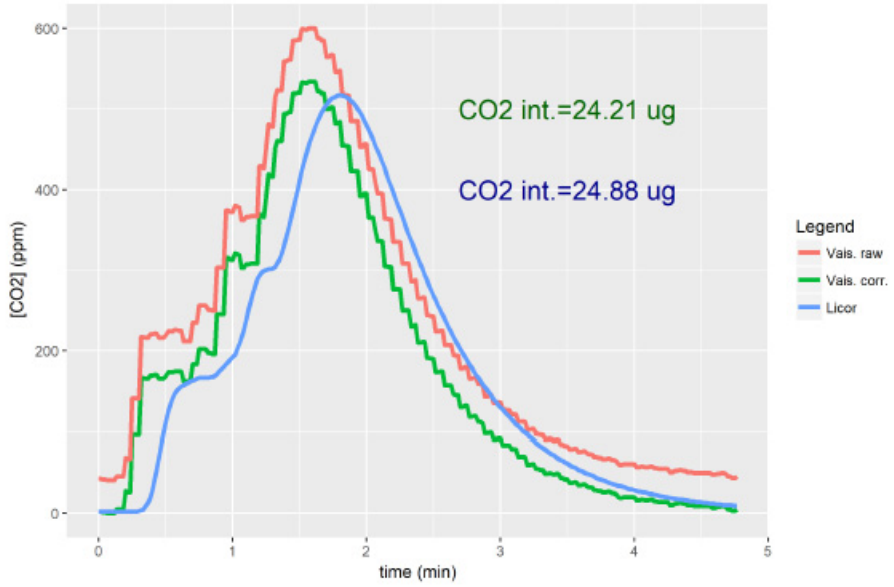

Figure S5: Measurement of a CO_2 peak from the combustion of an aerosol sample by the Vaisala and the LICOR connected in series. The graph includes the results of the peak integration of the calibrated Vaisala and the LICOR time series of CO_2 concentrations.