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Combustion characteristics of water-insoluble elemental and organic carbon in size selected ambient aerosol particles

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Abstract. Combustion of elemental carbon (EC) and organic carbon (OC) contained in ambient aerosol matter was explored using scanning electron microscopy (SEM) in combination with energy dispersive X-ray analysis (EDX). To ease identification of the particles of interest and to avoid or at least reduce interaction with simultaneously sampled inorganic oxides and salts, the approach used in this work differed in two ways from commonly applied procedures. First, rather than using a mixture of particles of vastly different sizes, as in PM10 or PM2.5, aerosol matter was collected in a 5-stage impactor. Second, the water soluble fraction of the collected matter was removed prior to analysis. Diesel soot particles, which appeared in the well-known form of chain-type aggregates, constituted the major fraction of EC. In contrast, OC containing particles were observed in a variety of shapes, including a sizable amount of bioaerosol matter appearing mostly in the size range above about 1 µm. During heating in ambient air for 1h, diesel soot particles were found to be stable up to 470°C, but complete combustion occurred in a narrow temperature interval between about 480 and 510°C. After diesel soot combustion, minute quantities of "ash" were observed in the form of aggregated tiny particles with sizes less than 10 nm. These particles could be due to elemental or oxidic contaminants of diesel soot. Combustion of OC was observed over a wide range of temperatures, from well below 200°C to at least 500°C. Incompletely burnt bioaerosol matter was still found after heating to 600°C. The results imply that the EC fraction in aerosol matter can be overestimated significantly if the contribution of OC to a thermogram is not well separated.

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