



The organic fraction of bubble-generated, accumulation mode Sea Spray Aerosol (SSA)

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Recent studies have detected a dominant accumulation mode (~100 nm) in the Sea Spray Aerosol (SSA) number distribution. There is evidence to suggest that particles in this mode are composed primarily of organics. To investigate this hypothesis we conducted experiments on NaCl, artificial SSA and natural SSA particles with a Volatility-Hygroscopicity-Tandem-Differential-Mobility-Analyser (VH-TDMA). NaCl particles were atomiser generated and a bubble generator was constructed to produce artificial and natural SSA particles. Natural seawater samples for use in the bubble generator were collected from biologically active, terrestrially-affected coastal water in Moreton Bay, Australia. Differences in the VH-TDMA-measured volatility curves of artificial and natural SSA particles were used to investigate and quantify the organic fraction of natural SSA particles. Hygroscopic Growth Factor (HGF) data, also obtained by the VH-TDMA, were used to confirm the conclusions drawn from the volatility data. Both datasets indicated that the organic fraction of our natural SSA particles evaporated in the VH-TDMA over the temperature range 170–200 °C. The organic volume fraction for 71–77 nm natural SSA particles was 8±6%. Organic volume fraction did not vary significantly with varying water residence time (40 s to 24 h) in the bubble generator or SSA particle diameter in the range 38–173 nm. At room temperature we measured shape- and Kelvin-corrected HGF at 90% RH of 2.46±0.02 for NaCl, 2.35±0.02 for artificial SSA and 2.26±0.02 for natural SSA particles. Overall, these results suggest that the natural accumulation mode SSA particles produced in these experiments contained only a minor organic fraction, which had little effect on hygroscopic growth. Our measurement of 8±6% is an order of magnitude below two previous measurements of the organic fraction in SSA particles of comparable sizes. We stress that our results were obtained using coastal seawater and they can't necessarily be applied on a regional or global ocean scale. Nevertheless, considering the order of magnitude discrepancy between this and previous studies, further research with independent measurement techniques and a variety of different seawaters is required to better quantify how much organic material is present in accumulation mode SSA.

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