CCN activity of black carbon particles coated with organics of varying solubility

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Atmospheric aerosol particles influence the climate by absorbing the incoming solar radiation and thus directly heating the atmosphere (direct effect) and by acting as cloud condensate nuclei (CCN) that form cloud droplets (indirect effect) (Boucher *et al.*, 2013). During past decades, black carbon (BC) or soot particles have been shown to cause positive radiation forcing when released into atmosphere in large quantities. These particles are typically emitted from incomplete combustion of fossil fuels and biomass burning (Bond *et al.*, 2013). While BC-particles are typically insoluble in water and possess low hygroscopicity, other more hygroscopic material can condense on them and thus increase their CCN activity (Henson 2007).

In this study, we investigated the CCN activity of BC particles coated with organic compounds. As proxy for BC-particles we used Regal Black 400R (Cabot Corporation). The organic compounds used as coating material were chosen because of their range of solubility. The BC particles coated with succinic acid, glutaric acid or levoglucosan were characterised with a single column CCN-counter (Droplet Measurements Technologies), a Scanning Mobility Particles Sizer (SMPS)-system (TSI Inc.) and an Aerosol Mass Spectrometer (AMS) (Aerodyne Research Inc.). Differences between the electrical mobility diameter measured by SMPS and vacuum aerodynamic diameter measured by AMS suggest that Regal black particles are agglomerates rather than compact spheres.

Changes in critical supersaturation of BC particles with increasing coating thickness of levoglucosan can be seen in Fig 1. Theoretical lines have been calculated using shell-and-core model which was introduced by Kumar *et al.* (2011) for insoluble dust coated by a soluble salt. Shell-and-core model predicts the CCN activity of the coated soot particles reasonably well. Similar trends are also seen with the other coating materials.

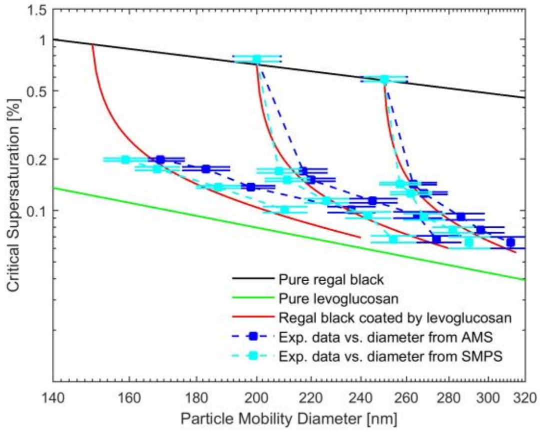

Figure 1: Critical supersaturation vs. dry particles mobility diameter for Regal Black particles coated with levoglucosan.

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