Blooming trees as a source of fine (< 5μm) aerosol particles

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During the blooming season of trees, pollen is an important component of the atmospheric aerosol, even in urban areas. Wind pollinated plants such as early flowering trees (e.g. birch, alder) release pollen grains in extremely large quantities. Once in the atmosphere pollen can impact human health and cloud formation (Schäppi et al. 1999, Pummer et al. 2012, Steiner et al. 2015). Intact pollen grains are rather large with geometrical diameters from 10-100 μm and therefore have short residence times in the atmosphere. However, it is known that under certain conditions (high humidity and after germination) pollen grains release cytoplasmic material including starch granules from their interior, commonly referred to as subpollen particles (SPP). Studies have shown that the cytoplasmic material contains cloud active substances and allergens (Steiner et al. 2015, Pummer et al. 2012, Basci et al. 2006). How and if this material becomes airborne and whether it distributes in the atmosphere is still an open question. Motivated by this question we took a detailed look at the particles shed from blooming catkins.

In this study freshly harvested branches with flowering catkins of different trees were put in an aerosol chamber. An Aerodynamic Particle Sizer (TSI Spectrometer 3321; 0.5 – 20 μm) and a Cascade Impactor (Sioutas; 2.5 μm, 1.0 μm, 0.50 μm, 0.25 μm) were attached to the chamber to sample the released aerosol. The catkins were agitated with puffs of clean air to simulate wind. The aerodynamic diameters of the released particles were recorded and the filters of the impactor were analyzed with a Scanning Electron Microscope and a light microscope. We find that not only large pollen grains are released but also smaller particles. Up to 50% of all released particles were in the size range from (0.5 – 5 μm). Additionally, we find that the aerodynamic diameter of pollen grains is in general smaller than their geometrical diameter. For instance, the aerodynamic diameter of pollen grains from birch is 30-70% smaller than the geometrical diameter.

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