



Particle formation from stress-induced BVOC emissions from poplar is inhibited by isoprene

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We measured the formation of secondary organic aerosols (SOA) from stressed-induced emissions of biogenic volatile organic compounds (BVOC) emitted from grey poplar (*Populus x canescens*). Measurements were conducted in the Juelich plant atmosphere chamber (JPAC) under controlled conditions. BVOC emitted from poplar plants in a plant chamber were transferred into a reaction chamber where they were oxidized by ozone and by OH radicals. Comparing particle formation from BVOC emitted from isoprene emitting wild type (WT) poplar to particle formation from transgenic poplar lines down-regulated in isoprene emission (R-lines) enabled characterization of isoprene's impact on SOA formation.

In unstressed wild type poplars the emission profile is nearly exclusively dominated by isoprene while in transgenic isoprene emission-repressed lines the emission rates were approximately an order of magnitude lower. Using these unstressed plants as BVOC source for particle formation we found inefficient SOA formation. For WT poplars the nucleation rates were far below $1 \text{ cm}^{-3} \text{ s}^{-1}$. Unstressed R-lines stimulated no particle formation.

Poplar plants, WT and R-lines, stressed by short ozone pulses showed strong additional emissions of sesquiterpenes and aromatic volatiles. These emissions increased and decreased on a time scale of several days allowing to study particle formation under steady state conditions similar to studies with constitutive emissions. Feeding the BVOC mixes including sesquiterpenes and aromatic compounds into the reaction chamber and inducing production of OH radicals by ozone photolysis resulted in very strong SOA formation events with nucleation rates exceeding $3000 \text{ cm}^{-3} \text{ s}^{-1}$. Nucleation rates were depended on the BVOC turnover in the reaction chamber. After normalizing to the turnover, nucleation rates were generally lower for the isoprene emitting WT type. This observation confirmed former findings of suppression of nucleation by isoprene.

Rapid changes in light intensity of the plant chamber caused fast changes of isoprene emissions whereas the emission rates of the other BVOC more slowly responded to these changes on a time scale of several hours. Again, inducing particle formation from the emission mix of WT plants caused a minor SOA formation event compared to R-line emissions. Switching off the photosynthetic light during the SOA formation event caused a fast decrease of isoprene emission and hence isoprene concentrations in the reaction chamber. This decrease was paralleled by an increase of SOA formation and an increase of OH concentrations. We therefore conclude that suppression of OH concentrations by isoprene is a major reason for suppression of nucleation from non-isoprene BVOC.