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Early season BVOC emission from young potted Norway spruce

Biogenic volatile organic compounds (BVOC) are emitted naturally from the biosphere to the atmosphere and are a part of the global carbon emissions. BVOCs are contributing to around 5-10% of the total net carbon exchange to the atmosphere. The BVOC emissions from the biosphere are mainly from plants and other organisms and consists of many different compounds, such as isoprene, monoterpenes (MT) and methanol. BVOCs have a high chemical reactivity and reactions with atmospheric compounds leads to oxidization of BVOCs, which contributes to formation of cloud condensation nuclei and secondary organic aerosols, affecting the solar radiation penetration and particle composition of the atmosphere, making the study of BVOCs important. The compounds produced are affected by different environmental factors such as light, temperature and stress.

This thesis analyzed the relationship of BVOC emissions affected by light and mechanical stress on young potted Norway spruce (*Picea abies*) by using proton transfer reaction – time of flight mass spectrometry combined with a portable photosynthesis system with a conifer chamber.

Despite the choice of instrument, no sesquiterpene emissions could be detected. The results of the thesis reveal differences in emissions for the different spruces, where MT emissions for spruce 2 were twice as high than for spruce 6. However, isoprene and methanol emissions were not found for spruce 2 but emitted from spruce 6 indicating differences between the spruces. Differences between branches of the same spruce were found as well, where branch 1 on spruce 2 emitted MT in a range between 0.13 and 0.24 $\mu g\ gdw^{-1}\ h^{-1}$, emissions in line with published research, while the other branches had emissions closer to 0 $\mu g\ gdw^{-1}\ h^{-1}$. The light response measurements revealed the increase with light of emissions to be 10 to 40 times lower for all compounds compared to published research. The analyze of mechanical stress by cutting the needles revealed expected results with induced emissions for all compounds, and up to two orders of magnitude for MT compared to before mechanical damage. Isoprene revealed higher induced emissions directly after cut in light conditions compared to dark conditions. The decay of the emissions after cut showed no difference in light or dark conditions for the compounds.

The results of this thesis are compared to published literature analyzing mature spruce stands during an entire season, which makes the comparison uncertain, however, some of the spruces in this thesis did show emissions on the lower end of the published research.

Keywords: Physical Geography and Ecosystem analysis, BVOC, Norway spruce, PTR-TOFMS, photosynthesis

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Master degree project 30 credits in Physical Geography and Ecosystem Science, 2019
Department of Physical Geography and Ecosystem Science, Lund University. Student thesis series INES nr 468