Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.14358

Dissolved organic matter molecular composition among Arctic ecosystems: A successful example of Fourier-transform mass spectrometry application to environmental studies

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Dissolved organic matter (DOM) is a small but very reactive pool of organic matter. Its environmental functions are related to its composition, which depends on its origins. In soils, vegetation is the foremost producer of DOM, but the regulating mechanisms transform and transport it. Furthermore, in climate-sensitive ecosystems such as the Arctic, vegetation cover compositions and hence sources of DOM are expected to change. Therefore, it is a topical challenge to correlate DOM composition to its origins. In recent years, Fourier-transform mass spectrometry (FTMS) has become an essential tool for the molecular-level identification of DOM compounds. This study aims to unravel DOM composition and sources using high-resolution mass spectrometry (HRMS) Orbitrap.

Natural DOM samples from contrasted Arctic ecosystems were collected in the summer. Their molecular compositions were assessed through HRMS Orbitrap. The molecular signatures of DOM samples were compared to each other to quantify the proportion of ubiquitous compounds. Then, DOM composition was compared to the previously acquired molecular fingerprints of fresh and biodegraded vegetation-derived WEOM to determine DOM sources. At last, these results were compared to vegetation cover composition to assess the influence of vegetation on DOM composition.

The results highlighted that the most important (51-75 %) proportion of identified compounds was ubiquitous. Despite these similarities, it was possible to differentiate ecosystems based on their DOM composition. Furthermore, the comparison to vegetation-derived WEOM enabled us to conclude that natural DOM was highly influenced by (1) degraded vegetation WEOM (rather than fresh) and (2) shrubs (rather than lichens and graminoids). At last, the comparisons between the vegetation cover compositions and the proportion of vegetation-derived compounds to DOM molecular signature showed a significant positive correlation for *B. nana* but not for other studied species.

In conclusion, this study highlighted that as a consequence of climate change, and vegetation shift, DOM sources will also shift. This might induce a significant modification of DOM composition and environmental functions. At last, this study is a successful example of the FTMS use benefits for biogeochemical studies: FTMS provided valuable information on the DOM origins and the influence of vegetation species on DOM composition.