# Chemical characterization of water extractable organic matter from plants: A better understanding of soil dissolved organic matter sources and path in permafrost thawing regions

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# Chemical characterization of water extractable organic matter from plants: A better understanding of soil dissolved organic matter sources and path in permafrost thawing regions

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In present permafrost thawing context, dissolved organic matter (DOM) is a key component that controls organic and inorganic material transfer from soil to hydrographic systems. In terrestrial environments, vegetation is the main source of DOM, before degradation by microorganisms. DOM stoichiometry, aromaticity, composition or quantity control its fate, and referential data characterizing the initial DOM originating from plant biomass leaching are scarce.

To better understand its dynamic, this study focuses on the characterization of water extractable organic matter ("WEOM": a proxy of DOM) of main plant species belonging to different plant functional types typical of the subarctic region (lichen, willow, birch, and *Eriophorum*).

Dissolved organic carbon (C) and dissolved nitrogen (N) contents of WEOM samples were measured, as well as organic C and total N contents of ground plant leaf samples ("bulk" samples). C/N ratio of bulk samples and WEOM fractions were compared to evaluate the potential extractability of C and N. The composition of both WEOM and bulk samples were characterized through solid state $^{13}C$ Nuclear Magnetic Resonance (NMR) and compared. Absorbance and 3D fluorescence measurements were also performed on WEOM samples to characterize their optical properties.

WEOM is significantly more extractable in vascular plants compared to non-vascular ones. Moreover, N is more extractable than C in all lichen species and *Eriophorum*, whereas C is as extractable as N in *Salix* and *Betula pubescens* samples. *Betula nana* is the only species with C more extractable than N.

The solid state $^{13}C$ NMR spectra of bulk sample are very similar to the spectra of corresponding WEOM, except for *Eriophorum*. For this species, carbonyl C contributes to 5% of bulk sample spectrum, compared to 14% of the WEOM spectrum.

Based on absorbance measurements, optical index were calculated: E2/E3 is significantly higher for non-vascular plants, whereas E2/E4, E3/E4 and slope ratio ($S_R$) do not show significant difference between plant functional types. In 3D fluorescence spectra, the contribution of "Protein-like" peak is lower for vascular plants compared to lichens, and is maximum for *Eriophorum*.

Our results highlighted the influence of plant species on the quantity and quality of produced DOM: WEOM production process is different between vegetation species due to the quality, especially hydrophobicity and extractability of bulk OM components. The high contribution of C-N bonds in WEOM of *Eriophorum* might be especially important for potential complexation between DOM and trace elements like cadmium (Nigam et al., 2000). Likewise, aromatic C observed only in vascular plant WEOM samples are known to bond have a good affinity with many elements like iron, vanadium and chromium (Gangloff et al., 2014). Under climate change, vegetation cover of the Arctic region is evolving with the moving of the treeline northward and a local increase of the proportion of shrubs (Berner et al., 2013). Accordingly, significant change of DOM composition are expected with potential influence on organic and inorganic material dynamics.

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