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DOM biodegradability assessed in a land covering lake survey in Norway: does DOM character dominate environmental controls?

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Biodegradability of DOM is controlled by both external environmental factors and by DOM character itself. Currently in the literature, more emphasis is being placed on the role of environmental parameters, and the idea of refractory molecules is being challenged. Biodegradation is the most important transformation process for DOM in lakes and has implications such as fuelling the lower food-web with energy/carbon and producing greenhouse gases. To be able to predict ecological responses to future climatic conditions, a better understanding of the controlling factors of DOM biodegradability is needed.

Here, we present a unique dataset on lake DOM characteristics from an extensive land-covering survey from Norway. The total of 333 different lakes included cover different catchment types such as lowland boreal forests, coastal impacted areas, alpine mountains, and arctic conditions, and with a wide range in catchment-to-lake ratios. The samples were collected using helicopter during the autumn of 2019, just after water mixing, and the samples were analysed immediately upon arrival at the laboratory. The lakes range in TOC concentration from 0.25 to more than 25 mg L⁻¹.

Principal DOM characterisation methods included the acquisition of fluorescence excitation-emission matrices in combination with parallel factor analysis (EEM-PARAFAC) and the assessment of intrinsic DOM biodegradability. The latter was determined by measuring O₂ consumption during 24 h using a batch experimental setup, after re-inoculating filtered (0.2 µm) lake DOM samples with a standard environmental inoculum.

The aim of this study is, by contributing with unique spatial data, to reveal the controlling factors of DOM biodegradability in lakes. The measured DOM biodegradability will be linked to structural information of the DOM molecules, extracted from the EEMs, and to environmental parameters such as water chemistry, local climatic conditions, and other catchment characteristics.