

Publication

A new method for the determination of primary and secondary terrestrial and marine biomarkers in ice cores using liquid chromatography high-resolution mass spectrometry

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The majority of atmospheric compounds measured in ice cores are inorganic, while analysis of their organic counterparts is a less well developed field. In recent years, understanding of formation, transport pathways and preservation of these compounds in ice and snow has improved, showing great potential for their use as biomarkers in ice cores. This study presents an optimised analytical technique for quantification of terrestrial and marine biosphere emissions of secondary organic aerosol (SOA) components and fatty acids in ice using HPLC-MS analysis. Concentrations of organic compounds in snow and ice are extremely low (typically ppb or ppt levels) and thus pre-concentration is required prior to analysis. Stir bar sorptive extraction (SBSE) showed potential for fatty acid compounds, but failed to recover SOA compounds. Solid phase extraction (SPE) recovered compounds across both organic groups but methods improving some recoveries came at the expense of others, and background contamination of fatty acids was high. Rotary evaporation was by far the best performing method across both SOA and fatty acid compounds, with average recoveries of 80%. The optimised pre-concentration - HPLC-MS method achieved repeatability of 9% averaged for all compounds. In environmental samples, both concentrations and seasonal trends were observed to be reproducible when analysed in two different laboratories using the same method.

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