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PTR-MS for Analyzing Dissolved and Particulate Organic Matter in Ice Cores

Content

The chemical fingerprint of particulate and dissolved organic matter in deep ice holds information about Earth's past climate and environmental state. Organic compounds can be used as unique tracers of e.g. biomass burning and marine biological productivity, and can be more source specific than inorganic tracers. However, the analysis of organic compounds in ice cores is connected to some analytical challenges. The low concentration of organic compounds in ice cores has limited their analysis, but improvements in the sensitivity of instruments has enabled their detection. The omnipresence of organic compounds in the environment has also provided difficulties, including contamination of the samples and low signal-to-noise ratios. Improved decontamination and sampling procedures have reduced the interaction between the ice core sample and the ambient environment and thus improved the measurements of organic matter.

Proton transfer reaction mass spectrometry (PTR-MS) is a sensitive technique which can detect organic trace gases at concentrations as low as a few parts-per-trillion (ppt). PTR-MS has been used for ambient pollution and air quality studies. The method produces high sensitivity and high-resolution measurements, which makes it ideal for application in ice cores sciences. The scope of this work is to couple PTR-MS to continuous flow analysis of ice core samples. This will allow continuous measurements of a large range of organic compounds with high resolution in ice cores, which will unveil patterns in the organic aerosol content of the past atmosphere. The studies of organic compounds in ice cores are limited, and the development of this method can help us gain knowledge on how organic compounds in the past atmosphere played a role in the Earth's climate.

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