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Compound-specific delta18O analyses of neutral sugars in soils using GC-Py-IRMS

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Stable oxygen isotopes (delta18O) are a valuable (paleo-)climate proxy applied to ice cores, deep sea sediments, speleothems and lake sediments. For instance, there has been made much effort to assess delta18O of cellulose from lake sediments. However, purity grade of the extracted cellulose and hygroscopy are analytical problems. In order to overcome these problems, we tested compound-specific delta18O analyses of neutral sugars using gas chromatography – pyrolysis – isotope ratio mass spectrometry (GC-Py-IRMS). Although this technique is available for about the last ten years, it is hardly applied so far. We ensured quantitative conversion of organically bound oxygen to CO in the pyrolysis reactor by monitoring not only mass 28 but also mass 44 (CO2) and excluded oxygen contamination in our system by co-analysing oxygen-free compounds (alkanes). Neutral sugars from litter and topsoils were extracted hydrolytically and measured after derivatization with methylboronic acid (MBA) and N,O-bis(trimethylsilyl)trifluoroacetamide (BSTFA). Corrections were made using sugar standards measured in alternation with the samples to ensure the 'principle of identical treatment' and for the hydrolytically introduced and exchangeable carbonyl-oxygen bound to C1 in the alditose sugar molecules. First results are promising for the hemicellulose-derived sugars arabinose and xylose as well as for the microbial-derived sugars fucose and rhamnose. Ongoing work focuses on assessing also cellulose-derived glucose and on the analytical elimination of the carbonyl-oxygen of the sugars.