New method for hydrogen isotope analysis of non-structural carbohydrates

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Analysing stable isotope composition of biologic components can be a powerful tool to reconstruct past environmental conditions, physiological responses, and to trace metabolic pathways. The analysis of the carbon-bound non-exchangeable hydrogen isotope ratios (δ²H̅NE) in carbohydrates can be challenging, partly due to the exchangeability of oxygen-bound hydrogen in the same molecule with those in water or vapour. To eliminate such sample alterations, carbohydrates have been nitrated to substitute exchangeable hydrogen with nitrate ester. However, the nitration of carbohydrates is time consuming, needs high sample amount, has several safety issues, and the nitrated products of short-chained carbohydrates are instable. δ²H̅NE of sugars derived from living organisms or directly from the environment are thus still limited and not widespread available. Here we optimized recent δ²H̅NE methods, with the focus on plant-derived non-structural carbohydrates such as starch, sugars, and sugar alcohols. The exchangeable hydrogen is replaced via equilibration with water vapour of a known isotopic composition to calculate δ²H̅NE. In this presentation, we will explain the new δ²H̅NE method, discuss precision, accuracy, as well as referencing strategies, and give a first outlook for future applications in plant and environmental sciences.