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Determining the dynamics of amino sugars in soils using HPLC-IRMS

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Within the global warming context, carbon sequestration is of growing importance. The storage of carbon in soil is closely related to the dynamic of soil organic matter (SOC) which is a result of the turnover of the different organic molecules constituting it. Mineralization and transformation of SOC is largely driven by soil microorganisms, making the study of the dynamics of microbial derived sequestrated organic molecules of outermost importance in order to have a better understanding of the C-biogeochemistry.

Cell walls of fungi, bacteria and actinomycetes are partially constructed of polymers of amino sugars. These amino sugar polymers are recalcitrant in soil after cell dead, which led to their use as biomarkers for microbial necromass. Recently a compound specific isotope analyses method for amino sugars in soils, which doesn't include a derivatization step due to the use of HPLC-IRMS technology, allows the simultaneous measurement of the relative and absolute amounts of amino sugars in soil, together with their individual δ^{13}C values with a standard error lower than 0.5‰

Long- and short-term isotopic in situ labeling allows us to quantify fluxes and transformations of different amino sugar pools over various time scales. For long-term dynamics, amino sugar extracted from soils with a historical alteration of the δ^{13}C signature of the carbon input (specific C3-C4 plant growth history and FACE (Free-Air Carbon Dioxide Enrichment) experiment) is used. The short term dynamics of free amino sugars in soil are assessed using pool dilution experiment with highly isotopicaly enriched amino sugars. The implementation of the isotopic information to a recently developed compound-specific model of soil organic carbon dynamics offers a better understanding of the role of microorganisms toward the dynamic of SOC and the contribution of amino sugar to C-sequestration.