



Fate of lignin, cutin and suberin in soil organic matter fractions – an incubation experiment

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The turnover of soil organic matter (SOM) is controlled by its chemical composition, its spatial accessibility and the association with the mineral phase. Separation of bulk soils by physical fractionation and subsequent chemical analysis of these fractions should give insights to how compositional differences in SOM drive turnover rates of different size-defined carbon pools.

The main objective of this study was to elucidate the relative abundance and recalcitrance of lignin, cutin and suberin in aggregated bulk soils and SOM fractions in the course of SOM decomposition. Bulk soils and physically-separated size fractions (sand, silt and clay) of the Ah horizon of a forest soil (under *Picea abies* L.Karst) were parallel incubated over a period of one year. In order to differentiate between particulate OM (POM) and mineral-associated SOM the particle size fractions were additionally separated by density after the incubation experiment. We used solid-state ^{13}C -CPMAS NMR spectroscopy and GC-MS (after copper oxide oxidation and solvent extraction) to analyze the composition of the incubated samples. The abundance and isotopic composition (including ^{13}C and ^{14}C) of the respired CO_2 further enabled us to monitor the dynamics of SOM mineralization. This approach allowed for differentiating between C stabilization of soil fractions due to accessibility/aggregation and to biochemical recalcitrance at different scales of resolution (GC-MS, NMR).

We found a relative enrichment of alkyl C and decreasing lignin contents in the order of sand < silt < clay by ^{13}C -NMR spectroscopy and GC-MS within soils and fractions before the incubation, resulting in increased lipid to lignin ratios with decreasing particle size. An accumulation of aliphatic C compounds was especially found for the small silt and clay sized particulate OM (POM).

For the fresh particulate OM (POM) of the sand fraction a clear decay of lignin was observed in the course of the incubation experiment, indicated by decreasing C/V and increasing ac/alV ratios. A relative decrease of aliphatic C in the incubated fractions compared to the incubated bulk soils showed the preferential mineralization of less recalcitrant C compounds that were spatially inaccessible in aggregates of the bulk soil. Differences in the abundance of lignin monomers, hydroxyl acids, n-alkanols and n-fatty acid methyl esters measured by GC MS before and after the incubation indicated selective degradation and preservation patterns at the molecular scale.