



The carbohydrate signature of soils

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Carbohydrates are present in soils mainly in the form of polysaccharides. During the decomposition of plant residues, the plant-derived crystalline cellulosic and non-cellulosic polysaccharides are almost completely lost. Microbial polysaccharides are built up by the microbial biomass, and are stabilized in the mineral soil. Recent research shows that stabilization occurs mainly via association with the soil mineral phase. In addition to clay minerals the binding to iron oxides seems to be of major importance. Studies in different soil types provide evidence for the association of carbohydrates with the soil mineral phase and with iron oxides in particular. Evidence comes from ^{13}C NMR spectroscopic and chemolytic methods for the analysis of polysaccharides and from selective dissolution of soil minerals. Additional evidence for the specific association of polysaccharides with iron oxides comes from the fact that polysaccharides show a spatial pattern in soil related to the spatial pattern of the mineral phase. Association mechanisms with soil minerals discussed currently in the literature are sorption of dissolved organic matter, co-precipitation, and association of microbial residue particles with soil minerals. As indicated from radiocarbon as well as stable isotope approaches, the so-created polysaccharide pool of the mineral soil, particularly microbial sugars, which are enriched in finer particle size fractions, is fairly stable against decomposition, e.g. as induced by changes in site conditions.