



Combination of different methods to assess the fate of lignin in decomposing needle and leave litter

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Lignin is a major component of plant litter. However, its fate during litter decay is still poorly understood. One reason is the difficult analysis. Commonly used methods utilize different methodological approaches and focus on different aspects, e.g., content of lignin and/or of lignin-derived phenols and the degree of oxidation. The comparability and feasibility of the methods has not been tested so far.

Our aims were: (1) to compare different methods with respect to track lignin degradation during plant litter decay and (2) to evaluate possible advantages of combining the different results.

We assessed lignin degradation in decaying litter by ^{13}C -TMAH thermochemolysis and CuO oxidation (each combined with GC/MS) and by determination of acid-detergent lignin (ADL) combined with near infrared spectroscopy. Furthermore, water-extractable organic matter produced during litter decay was examined for indicators of lignin-derived compounds by UV absorbance at 280 nm, fluorescence spectroscopy, and ^{13}C -TMAH GC/MS. The study included litter samples from 5 different tree species (acer, ash, beech, pine, spruce), exposed in litterbags to degradation in a spruce stand for 27 months.

First results suggested stronger lignin degradation in coniferous than in deciduous litter. This was indicated by complementary results from various methods: Conifer litter showed a more pronounced decrease in ADL content and a stronger increase in oxidation degree of side chains (Ac/Al ratios of CuO oxidation and ^{13}C -TMAH products). Furthermore water extracted organic matter from needles showed a higher aromaticity and molecule complexity. Thus properties of water extractable organic matter seemed to reflect the extents of lignin degradation in solid litter samples. Contents of lignin-derived phenols determined with the CuO method (VSC content) hardly changed during decay of needles and leaves. These results thus not matched the trends found with the ADL method. Our results suggested that water-soluble phenolic acids that are included in the CuO oxidation products, accumulated during decay of litter with less stable lignin and then contributed to VSC contents and to the pool of water- extractable organic matter.

By combining results from different methods we gained a better understanding about the differences in lignin degradation between the litter species.