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How do molecular marker patterns of BC change at increasing age of chars?

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Black carbon (BC) is considered to be a relatively stable form of organic carbon. However, previous results have shown that the physical and chemical properties of BC can vary considerably with formation temperature. Thus, to understand the long-term carbon sink potential of BC there is increasing interest to gain more information about i) the conditions under which BC was formed, and ii) the resulting degradability of BC under natural conditions.

In a first step, we synthesised chars from two different sources of biomass (chestnut wood, rice straw) under well-defined conditions as model substances to analyse the changes in their molecular structure at increasing formation temperature. Results are presented obtained from a set of laboratory produced char samples pyrolysed at increasing temperatures with a high resolution between 200 and 1000 °C. The chars were characterized by a molecular marker method for pyrogenic carbon quantification, which additionally provides information about the degree of condensation of chars. At temperatures between 275 and 500°C, which typically are observed during wildfires and thus are relevant for natural char formation, the molecular marker pattern of the chars remains almost constant.

In a next step, we analysed changes in the molecular marker patterns of chars from a chronosequence, with BC deposited between 0 and 100 years ago. Based on the data obtained from the laboratory char series, we compare changes in the molecular marker patterns of the chars from the chronosequence over time. These results show if less condensed forms of BC are degraded preferentially and more condensed, aromatic backbone of BC becomes enriched in the soils with time of degradation. Our results provide information about the fate of BC in the environment, which has important implications in the context of carbon sequestration strategies.