Chapter Three - Heating up a cold case: Applications of analytical pyrolysis GC/MS to assess molecular biomarkers in peat

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Intact peatlands serve as a globally important carbon sink. However, impacts from climate change, extraction, and drainage increase aerobic decomposition in these ecosystems—shifting their carbon flux from sink to source. A variety of projects are ongoing to restore peatlands to their natural or near-natural states; however, for carbon sequestration, net accumulation of peat relative to decomposition is of primary importance. Molecular analysis techniques provide information on peat growth and degradation trends dating from centuries to millennia. Pyrolysis coupled to gas chromatography mass spectrometry (Py-GC/MS) has been proposed for the rapid characterization of molecular biomarkers in organic matter. This paper reviews plant and microbial biomarkers analyzable via Py-GC/MS for peatland ecosystems, associated challenges, and future applications of the technique. It is noted that far fewer organism-specific biomarkers have been identified via Py-GC/MS for microbial communities in comparison to plant-based studies, and as a topic remains an area greatly needing additional research. In the future, through improved Py-GC/MS-derived fingerprinting of peatland molecular components, periods of degradation and growth could be more precisely distinguished and described, even in profiles where changes in contributing source material are not macroscopically visible.
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