Distribution patterns and origins of \( n \)-Alkan-2-ones in surface peat and \textit{Sphagnum} in Chinese peatlands

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Abstract

\( n \)-Alkan-2-ones occur widely in peat deposits. Previous studies have indicated several possible origins for the \( n \)-alkan-2-ones, e.g. directly from peat-forming plant leaf waxes, oxidation products of \( n \)-alkanes and/or \( \beta \)-oxidation and decarboxylation of \( n \)-fatty acids. However, the distribution patterns of \( n \)-alkan-2-ones in different peatlands were not consistent, suggesting that the source of these compounds might have regional difference. In this study, the lipid distributions (\( n \)-alkanes, \( n \)-alkan-2-ones and \( n \)-alkanoic acids) in surface peat from five Chinese peatlands (YC, HN, DJH, SWGT and REG) were determined, together with the occurrence of \( n \)-alkan-2-ones in fresh \textit{Sphagnum}.

In most cases the \( n \)-alkan-2-ones ranged from \( C_{21} \) to \( C_{31} \), exhibiting an odd/even carbon number predominance. Interestingly, the \( n \)-alkan-2-one distributions in YC, HN, DJH and SWGT maximized at \( C_{27} \), consistent with previous studies in the higher latitude of the Northern Hemisphere. This suggested that there may be some similarities in the source of \( n \)-alkan-2-ones in these peatlands. In contrast, the non-\textit{Sphagnum} REG had a completely different distribution pattern of \( n \)-alkan-2-ones, with a maximum at \( C_{23} \). The correlation analysis revealed that there are positive correlation between \( C_{23} \) and \( C_{25} \) \( n \)-alkan-2-ones, also between \( C_{29} \) and \( C_{31} \) \( n \)-alkan-2-ones in YC, HN, DJH and SWGT peatlands. Meanwhile, slight negative correlations were also found between medium chain ketones (\( C_{21}, C_{23}, C_{25} \)) and long chain ketones (\( C_{29}, C_{31}, C_{33} \)), illustrating possible different sources of the former and the latter.

In REG, the distribution of \( n \)-alkanoic acids in REG had a good correlation with \( n \)-alkan-2-ones, supporting that \( n \)-alkan-2-ones in this non-\textit{Sphagnum} peatland may be produced by \( \beta \)-oxidation and decarboxylation of \( n \)-fatty acids. In contrast, the distribution patterns of \( n \)-alkanes in all peatland were different to those of \( n \)-alkan-2-ones, suggesting that the microbial oxidation of \( n \)-alkanes may not be the main source of \( n \)-alkan-2-ones. For \( n \)-alkanoic acids, in all samples from five peatlands, the \( C_{24} \) \( n \)-fatty acid was predominant. The \( \beta \)-oxidation and decarboxylation of the dominant \( C_{24} \) \( n \)-fatty acid would yield \( C_{23} \) \( n \)-alkan-2-ones, which was only minor components in YC, HN, DJH and SWGT peatlands. \textit{Sphagnum} samples collected from YC, DJH and SWGT were all dominated by \( C_{27} \), consistent with previous studies. Thus, it is probably that peat moss species are important sources of \( n \)-alkan-2-ones in \textit{Sphagnum} dominated settings. It is interesting to further discuss how environmental factors control the distribution of \( n \)-alkan-2-ones in these peatland samples.
Figure 1 The distributions of \( n \)-alkan-2-ones, \( n \)-alkanes, \( n \)-fatty acids in surface peat and \( n \)-alkan-2-ones in Sphagnum collected from YC, HN, DJH, SWGT and REG peatlands.

References