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Extraneous carbon assessment in ultra-microscale radiocarbon analysis using benzene polycarboxylic acids (BPCA)

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Measurements of the natural abundance of radiocarbon (^{14}C) concentrations in inorganic and organic carbon-containing materials can be used to investigate their date of origin. Particularly, the biogeochemical cycling of specific compounds in the environment may be investigated applying molecular marker analyses. However, the isolation of specific molecules from environmental matrices requires a complex processing procedure resulting in small sample sizes that often contain less than 30 μg C. Such small samples are sensitive to extraneous carbon (C_{ex}) that is introduced during the purification of the compounds (Shah and Pearson, 2007).

We present a thorough radiocarbon blank assessment for benzene polycarboxylic acids (BPCA), a proxy for combustion products that are formed during the oxidative degradation of condensed polyaromatic structures (Wiedemeier et al, *in press*). The extraneous carbon assessment includes reference material for (1) chemical extraction, (2) preparative liquid chromatography (3) wet chemical oxidation which are subsequently measured with gas ion source AMS (Accelerator Mass Spectrometer, 5-100 μg C). We always use pairs of reference materials, radiocarbon depleted ($^{14}C_{fossil}$) and modern ($^{14}C_{modern}$) to determine the fraction modern ($F^{14}C$) of $C_{ex.}$Our results include detailed information about the quantification of C_{ex} in radiocarbon molecular marker analysis using BPCA. Error propagation calculations indicate that ultra-microscale samples (20-30 μg) are feasible with uncertainties of less than 10 %. Calculations of the constant contamination reveal important information about the source ($F^{14}C$) and mass (μg) of C_{ex} (Wacker and Christl, 2011) for each sub procedure. An external correction of compound specific radiocarbon data is essential for robust results that allow for a high degree of confidence in the ^{14}C results.

References

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