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Grass material as process standard for compound-specific radiocarbon analysis

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Compound-specific radiocarbon analysis (CSRA) is a powerful tool to study the carbon cycle and/or as a dating technique in paleoclimate reconstructions. The radiocarbon value of individual compounds can provide insight into turnover times, organic matter sources and in specific cases can be used to establish chronologies when traditional dating materials (e.g. macrofossils, pollen, charcoal) are not available. The isolation of compounds (or group of compounds) from parent material (e.g. soil, plant) for radiocarbon analysis can, however, introduce carbon contamination through chemical separation steps and preparative capillary gas chromatography (PCGC). In addition, the compounds of interest are often in low abundance which amplifies the contamination effect. The extraneous carbon can be of modern ^{14}C age and/or ^{14}C -free and its amount and ^{14}C value must be determined for a given system/isolation procedure in order to report accurate ^{14}C values. This can be achieved by using adequate standard materials but, by contrast with traditional radiocarbon dating, there are not established reference standards for CSRA work, in part because the type of standard material depends on the compounds of interest and the isolation procedure. Here we evaluate the use of n-alkanes extracted from single-year growth grass as modern process standard material for CSRA using PCGC isolation. The grass material has a known ^{14}C value of 1.224 $\pm$ 0.006 fraction modern (FM) and the individual n-alkanes are expected to have a similar ^{14}C value. In order to correct for the addition of extraneous carbon during PCGC isolation of the n-alkanes, we used commercially available compounds of modern ^{14}C content and ^{14}C -free (adipic acid, FM= 0.0015 $\pm$ 0.0001 and docosane, FM=1.059 $\pm$ 0.003) to evaluate our PCGC procedure. The corrected ^{14}C values of the isolated n-alkanes extracted from the modern grass are within one sigma of the grass bulk ^{14}C value for n-C_{29} and within two sigma for n-C_{23-C27}, C_{31} and C_{33}. Our results show that single-year growth grass can be a process standard suitable for quality control of extraction of n-alkanes (and potentially other compounds) from soil or plant material for CSRA.