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Analysis of black carbon molecular markers by two chromatographic methods (GC-FID and HPLC-DAD)

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The analysis of benzenepolycarboxylic acids (BPCA) as a quantitative measure for black carbon (BC) in soil and sediment samples is a well-established method [1, 2]. Briefly, the oxidation of polycondensated BC molecules forms seven molecular markers, which can be assigned to BC, and which subsequently can be quantified by GC-FID (gas chromatography with flame ionization detector). Recently this method has been refined for BC quantification in seawater samples measuring BPCA on HPLC-DAD (High performance liquid chromatography with diode array detector) [3]. However, a systematic comparison of BC as determined by both analytical techniques would be essential to the calculation of global BC budgets, but is lacking. Here we present data for the systematic comparison of the two BPCA methods, both for quantity and quality.

We prepared chars under well-defined laboratory conditions. Chestnut hardwood chips and rice straw were pyrolysed at temperatures between 200 and 1000°C under constant N2 stream. The BC contents of the chars have been analysed using the BPCA extraction method followed by either GC-FID or HPLC-DAD quantification [4].

It appears that the GC-FID method yields systematically lower concentrations of BPCA in the chars compared to the HPLC-DAD method. Possible reasons for the observed difference are i) higher losses of sample material during preparation for GC-FID; ii) different quality of the linear regression used for quantification; iii) incomplete derivatisation of B5CA and B6CA, which is needed for GC-FID analysis. In a next step, we will test different derivatisation procedures (methylation with dimethyl sulfate or diazomethane, and silylation) for their influence on the GC-FID results. The aim of this study is to test if black carbon can be quantified in soil, sediment and water samples using one single method − a crucial step when attempting a global BC budget.

References:

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