Geophysical Research Abstracts, Vol. 9, 02846, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02846


# Significance of biological black carbon production in soils

B. Glaser (1), K.-H. Knorr (2)

(1) Soil Physics Department, University of Bayreuth, Germany, (2) Hydrology Department, University of Bayreuth, Germany

Black carbon, a complex continuum of partly charred organic matter predominantly consisting of aromatic and graphitic moieties, has high potential for long-term atmospheric $CO_2$ sequestration and especially in poor soils of the humid tropics, also for soil fertility enhancement. To date it was speculated that black carbon is exclusively formed by incomplete combustion of organic matter, such as vegetation or fossil fuel, while non-pyrogenic sources, e.g. aspergillin, the black pigment of the fungus Aspergillus niger, are negligible. Investigating the stable carbon isotope signature of benzenepolycarboxylic acids (BPCA) as molecular markers for black carbon can help to elucidate origin and fate of black carbon in the environment. We adapted methods for compound-specific $\delta^{13}$C analysis of BPCA formed by hot nitric acid oxidation of different soils. Three different procedures were compared: (i) continuous flow elemental analysis – isotope ratio mass spectrometry (EA-IRMS) of bulk BPCA and gas chromatography – combustion – isotope ratio mass spectrometry (GC-C-IRMS) of (ii) BPCA trimethylsilyl (TMS) derivatives, and (iii) BPCA methyl derivatives. Comparison of BPCA $\delta^{13}$C values of soil samples with low natural black carbon contents prior to and after laboratory and field incubations with both positive and negative $^{13}$C labels at natural and artificial abundances revealed that up to 25% of black carbon in soils was of biological origin. Annually biological black carbon production ranged from 1 to 9%, depending on environmental conditions, such as soil temperature and atmospheric $CO_2$ concentration. Further research is highly encouraged to optimize environmental conditions for biological black carbon production in soils for soil fertility enhancement and $CO_2$ mitigation purposes.