



Total and bioavailable PAH concentrations in biochar – a future soil improver

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Biochar is pyrolyzed organic feedstock. It has become more and more important as soil conditioner and received broad attention as a possible measure against climate change. Polycyclic aromatic hydrocarbons (PAHs) are formed during biochar production due to incomplete combustion. These PAHs will enter the environment when the biochar is applied as soil conditioner to avoid leaching of nutrients, to increase microbial biomass and activity, to remediate the soil of organic pollutants, etc. Such positive effects are undermined if PAH exposure is concomitantly increased.

We have determined the total PAH concentrations of about 40 commercially produced biochars with an analytical method based on Soxhlet extraction with toluene optimized in our laboratory (Hilber et al.). The bioavailability of the PAHs in these biochars was assessed with polyoxymethylene (POM), a passive sampler, which measures the truly dissolved concentration of organic pollutants in the pore water, according to Hale et al. Samples from total and POM extractions were measured by GC-MS to determine the total and bioavailable concentrations of the 16 EPA PAHs, respectively.

Preliminary results showed that the total concentrations of the biochars ranged from 0.4 to 355 mg Σ 16 EPA PAH/kgBC. The bioavailable concentrations were in the nanograms per liter for the Σ 16 EPA PAH and goes in line with findings of recently published data of Hale et al. The fraction desorbed by POM in relation to the total concentrations is in the permill range.

Although the bioavailable concentration appears very small, it has to be considered that biochars might be applied to an agricultural field several times. Thus, the source of amended PAHs to the soil is renewed not only for the bioavailable but also for the total concentration. Biochar applications might become a problem especially for legislation accounting for total concentrations. The only guideline for biochars is from the International Biochar Initiative which set the maximum allowed threshold value at 6 mg Σ 16 EPA PAH/kgBC. Efforts of the producers to minimize the PAH concentrations towards or below this value as well as effects of the biochar's treatment as for example composting after pyrolysis or ozonation will be discussed in this study. Further, the bioavailable PAH will be considered under different aspects such as the fingerprints and compared with findings from other researchers.

References:

Hale et al. Quantifying the total and bioavailable polycyclic aromatic hydrocarbons and dioxins in biochars. *Env. Sci. Technol.* revised manuscript submitted

Hilber et al. Quantitative determination of PAHs in biochar – a prerequisite to assure its quality and safe application. *J. Agric. Food Chem.* submitted