

An accurate evaluation of the potential hazardous impact of Polycyclic Aromatic Hydrocarbons in biochars

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Biochar may act as a soil conditioner, enhancing plant growth by supplying and retaining nutrients and by providing other services such as improving soil physical, chemical and biological properties. Feedstock properties and production conditions drive the nature of produced biochars [1]. Special attention have to be paid to their content of polycyclic aromatic hydrocarbons (PAHs), which are persistent organic pollutants formed during biochar production due to incomplete combustion (pyrolysis step) [2]. These PAHs may enter the environment when the biochar is applied as soil conditioner. Therefore, the intention of this study was to test a potential hazardous impact of biochar amendment due to the presence of PAHs. In order to find a relationship between pyrolysis conditions, feedstock and abundance of PAHs, four biochars produced from different feedstock were analyzed. Three biochars were produced by technical pyrolysis (500-600 °C; 20 min) from wood, paper sludge and sewage sludge respectively (samples B1, B2 and B3). The fourth biochar sample derived from old grapevine wood by using the traditional carbonization method in kilns (kiln-stack wood biochar; B4). A detailed characterization of physical and chemical properties of these samples can be found in De la Rosa et al, [3]. Two different PAHs extraction techniques were applied to evaluate the total and available PAHs content of the biochars. They consisted in an extraction with toluene using a Soxhlet extractor and a non-exhaustive extraction with Cyclodextrins (CDs). Chromatographic and mass spectrometric conditions applied are described in [1].

Total PAHs yielded between 3 ppm (B3) and 7 (B4) ppm. The production of biochar by using traditional kilns instead of controlled pyrolysis, increased significantly the total PAHs levels. No direct relationship was found between the total PAHs and the PAHs extracted by CDs, which can be considered as the bioavailable fraction. This parameter should replace the total PAHs to determine the real hazardous impact of the use of biochar as soil amendment.

[1] J.M. De la Rosa, M. Paneque, I. Hilber, F. Blum, H. Knicker, T. Bucheli, *J. Soils and Sediments* 16 (2016) 557-565.

[2] T. Bucheli, I Hilber, H. Schmidt. In Lehmann J, Joseph S (eds) *Biochar for Environmental Management* (2nd ed.), Earthscan, London, UKA. (2015).

[3] J.M. De la Rosa, M. Paneque, A.Z. Miller, H. Knicker, *Science of the Total Environment* 499 (2014) 175-184.

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