applied sciences

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Editorial

Special Issue on "Environmental Applications of Biochar"

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Received: 21 August 2020; Accepted: 1 September 2020; Published: 2 September 2020

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Biochar is a carbon-rich solid obtained from the pyrolysis of organic feedstock under limited oxygen and at relatively low temperatures. Biochar addition to soil serves multiple purposes, including soil carbon sequestration [1], mitigation of the impact of pollutants [2,3] and increased soil fertility resulting in higher crop yields [4].

As a consequence of its molecular structure, carbon biochar is chemically and biologically in a much more stable form than that of the original feedstock, and therefore can be stored in soils for significantly longer periods of time, constituting a geoengineering approach for soil carbon sequestration. This potential for carbon sequestration is highly dependent on soil and biochar type. De Figueiredo et al. [1] use sewage sludge-derived biochars prepared at 300 °C, 400 °C, and 500 °C for the amendment of an Oxisol in a study intended to unravel the coupling of the C and N cycles. Biochars prepared at 300 °C and 400 °C exhibited higher soil C mineralization rates and N-NH_4^+ contents, indicating a better potential to be used to increase plant productivity. On the contrary, the biochar prepared at 500 °C presented more recalcitrant carbon, and was able to supply less inorganic N to the soil, therefore showing a better potential for carbon sequestration. This study is an excellent example of the different trade-offs that need to be considered when choosing a temperature for pyrolysis.

Masís-Meléndez et al. [5] characterized biochars prepated in a top-lit updraft (TLUD) stove, characterized by an intrinsically high variability of charring conditions. Biochars were prepared from waste pinewood and a Guadua bamboo. Biochars were mixed with composted human excreta at 5% and 10% biochar content. Bamboo biochars exhibited higher variability in their physico-chemical properties, and more suitable properties for agronomic purposes, including higher cation exchange capacity and available water content.

Much interest has been devoted in recent years to the remediation of mine contaminated sites with biochar [6,7]. Álvarez et al. [8] used biochar as an inexpensive material for the remediation of mining sites. The authors selected three mining soils with contrasting physico-chemical characteristics and four biochars prepared from manure and rabbit waste prepared at two different temperatures (450 °C and 600 °C). The study found biochar effects to be site and biochar specific. In one of the sites (Zarandas-Andalusia area), biochar addition reduced the mobility of Ni, Zn, Cd, Pb, and Cr, respectively, by 91%, 81%, 29%, 67%, and 70%, but these benefits were not found in the other two areas, where soils were alkaline. CO_2 emissions generally increased in the treated soils, with the exception being biochars produced at 600 °C, which resulted in reductions of CO_2 emissions of up to 28%.

Pokovai et al. [9] investigated the response of *Capsicum annuum* L. (pepper) to different doses of biochar amendments (0, 0.5%, 2.5%, and 5.0%). By the end of the experiment, plant height and fruit yield were 15.9 and 32.5% higher for the treatment, with 2.5% biochar compared to the control.

Root dry matter was the highest in the BC2.5, with a 54.9% increase compared to the control soil. Significant differences between control and biochar amended soils' photochemical reflectance index measurements were observed, showing less plant sensitivity to environmental changes when biochar was applied to the soil.

Overall, this Special Issue contains a significant amount of research work on environmental applications of biochar, covering carbon sequestration in soil, soil remediation, plant productivity and the characterization of biochar.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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