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Biochar: A Potential Soil Amendment

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INTRODUCTION

Biochar is a charcoal-like material which is made from plant materials such as grass, agricultural and forest residues that have decomposed at high temperatures, often during the production of renewable energy. It is the solid material that is obtained from the thermochemical conversion of biomass in an oxygen-limited environment. It is produced through pyrolysis or gasification, the process in which biomass is heated in the absence (or under reduction) of oxygen. During this process, the physical and chemical properties of the plant material change into biochar, which is a highly porous, stable, carbon-rich material. Biochar is a stable solid that is high in pyrogenic carbon and can last for thousands of years in the soil. According to recent research, it has the potential to be used as a soil conditioner and container substrate amendment in agriculture and horticulture, and it may improve soil's physical, chemical, and biological properties.

The potential for beneficial use of biochar depends upon its chemical and physical properties, which are further determined by how it is made and the type of plant material used as the feedstock, as well as the crop and cropping system to which the biochar is applied. Some of the properties of biochar derived from different sources are mentioned in the table below-

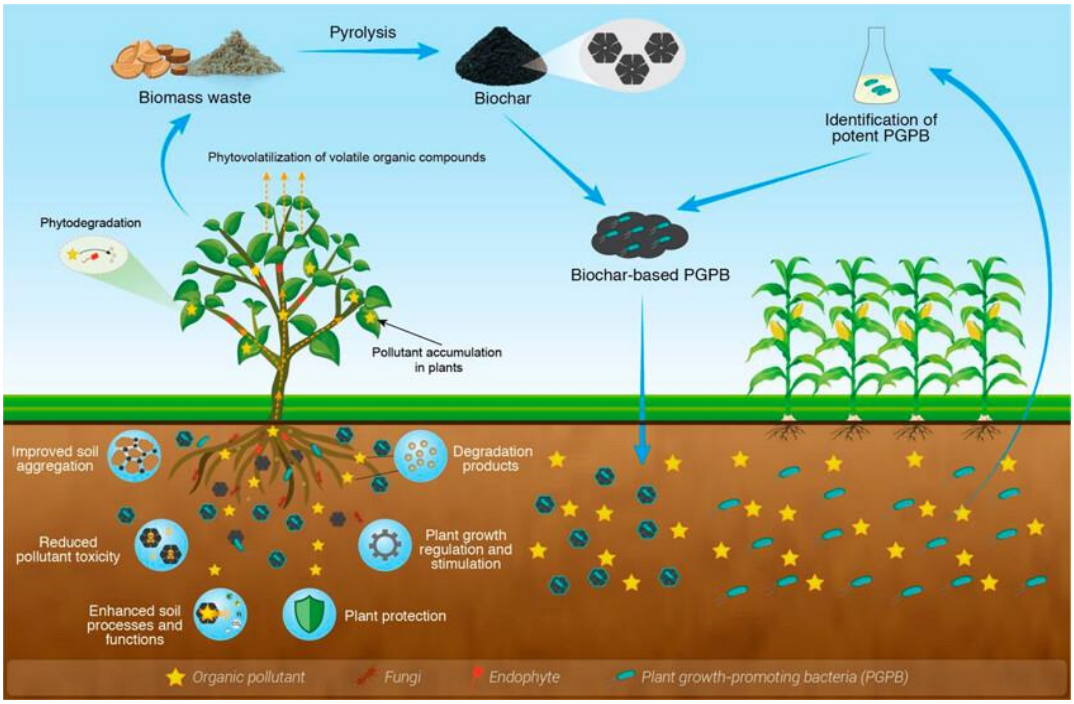
Table- Properties of biochar derived from different sources (Layek *et al.*, 2022)

Materials Used for Producing Biochar	pH	Total C (%)	Total N (%)	C: N Ratio	Ca (cmol/kg)	Mg (cmol/ kg)	P (cmol/kg)
Paper mill waste 1 (waste woodchip)	9.4	50.0	0.48	104	6.2	1.20	-
Paper mill waste 2 (waste wood chip)	8.2	52.0	0.31	168	11.0	2.60	-
Green waste (grass, cotton trash and plant prunings)	9.4	36.0	0.18	200	0.4	0.56	-
Eucalyptus biochar	-	82,4	0.57	145	-	-	1.87
Cooking biochar	-	72.9	0.76	96	-	-	0.42
Poultry litter (450 °C)	9.9	38.0	2.00	19	-	-	37.42
Poultry litter (550 °C)	13	33.0	0.85	39	-	-	5.81
Wood biochar	9.2	72,9	0.76	120	0.83	0.20	0.10
Hardwood sawdust	-	66.5	0.3	221	-	-	-

Potential Use of Biochar as a soil amendment

Biochar is very porous, has a high pH and carbon content, and has a much slower decomposition rate than the original biomass. All of these characteristics contribute to its potential to improve soil health. Adding biochar to soil or as a container substrate has several potential benefits and modifies the soil's physical and chemical properties. Biochar can be adapted with specific qualities to target distinct soil properties. Biochar could be ploughed into soils in crop fields to enhance their fertility and stability. It is regarded as a potential amendment of soil. It has the following effect on the soil-

1. **Cation exchange capacity (CEC)-** Biochar help in increasing the CEC of the soil
2. **Enhance microbial population-** Its porous structures are likely to provide a highly suitable habitat for microbes to colonize, grow and reproduce. It provides a microhabitat, particularly for bacteria, actinomycetes and arbuscular mycorrhizal fungi.
3. **Regulate nitrogen leaching-**It increases nutrient retention due to cation and anion exchange reactions and immobilization of inorganic N due to labile C fractions of biochar. Biochar could also prevent nitrification and denitrification losses by increasing the adsorption of ammonium and nitrate ions in the soil.
4. **Enhancing water-holding capacity-** Biochar due to its hygroscopic, as in able to absorb and hold water from the surrounding. Its porous nature is effective in retaining both water and water-soluble nutrients in the soil.
5. **Improves soil physical properties-** Biochar applied as an organic soil amendment contributes to the modifications of physical soil properties such as texture, structure, porosity and bulk density, which consequently increase water retention capacity
6. **Enhance plant nutrient availability-** Biochar also increases nutrient retention due to cation and anion exchange reactions. It has a high adsorption capacity. Biochar when ploughed into soils in fields could enhance their fertility and stability, and for medium- to long-term carbon sequestration in these soils. It helps reduce the fertilizer requirements by retaining the nutrient in the soil
7. **Enhancing soil structure** - Higher organic carbon content and surface charge in biochar plays a crucial role in enhancing soil aggregation and its stability. It forms complexes between organic matter and other minerals which aid in forming better soil aggregates. These stable aggregates further help to improve the structure of soil and thus improve soil moisture retaining capacity, infiltration, run-off reduction, and erosion.
8. **Reduce Chemical fertilizer-** Biochar's production and its effects on soils can reduce the need for commercial fertilizers
9. **Decreasing soil acidity**
10. **Improves electrical conductivity of the soil**



Effect of biochar on soil properties (source of the image- Xiang *et al*., 2022)

REFERENCES

Layek, J., Narzari, R., Hazarika, S., Das, A., Rangappa, K., Devi, S., ... & Mishra, V. K. (2022). Prospects of Biochar for Sustainable Agriculture and Carbon Sequestration: An Overview for Eastern Himalayas. *Sustainability*, 14(11), 6684.

Xiang, L., Harindintwali, J. D., Wang, F., Redmile-Gordon, M., Chang, S. X., Fu, Y., ... & Xing, B. (2022). Integrating biochar, bacteria, and plants for sustainable remediation of soils contaminated with organic pollutants. *Environmental Science & Technology*, *56*(23), 16546-16566.