



### Biochar from lignocellulosic and agriculture residues

Biochar is the solid product which, together with gas and a liquid component (Bio-oil), is obtained from the thermochemical conversion of lignocellulosic and agricultural biomass. These conversion processes include pyrolysis, gasification and hydrothermal carbonization. Slow pyrolysis is the biomass conversion process that maximizes the yield of charcoal in terms of solid residue; this product is mainly characterized by a high content of stable C and high porosity. Biochar is a charcoal-like product that is made via the modern pyrolysis, whereas charcoal is produced through different processes, and, unlike charcoal, is characterized by large poresurface area. Henceithas a large number on nonfuel use such as adsorption of chemicals and carbon storage in ground. In particular, biochar is considered an innovative soil improver, as it seems to preserve soil fertility by improving the physical-chemical and biological properties of soil, furthermore it increases the soil water holding capacity while storing stable carbon in the soil. Thanks to these characteristics, biochar has high chemical and biological stability and, due to its high porosity (depending on the technology and operating conditions of the production process), it can have a specific surface area in the order of hundreds of m<sup>2</sup>/g.

The use of biochar also improves other soil characteristics as the mechanical structure, density and texture that enhance also soil porosity, allowing a better aeration and increasing its water retention capacity. It also allows the increase of pH in acidic soils by improving the cation and anion exchange capacity. Biochar also supports the nutrient supply by reducing their leaching, stimulates an increased efficiency of the nitrogen cycle, fosters the carbon supply of organic matrix by establishing a wealthy habitat for the development of microorganisms and allows a better storage of carbon by increasing the soil capacities to fix atmospheric CO<sub>2</sub>. RE-CORD is a private-public non-profit Research & Development organization that was founded in 2010 to work in the field of renewable energies, biomass, bioenergy and bioeconomy. The organization is testing new feedstocks for biochar production (e.g. wood waste, agricultural residues, dedicated crops) to get new and fully characterized products also in compliance with the European and national regulations such as the Italian fertilizer law. The pilot plant implemented by RE-CORD requested an investment of 350,000 euros and has an electricity consumption during steady state operation of 17 kW and an operating cost of 45,000 euros/year. The plant can be operated even by non-highly qualified personnel and allows biochar to be produced in a sustainable way by using local raw materials and thus reducing waste generation and polluting emissions.

The economic perspective, according to the projections and considering the multiple markets, would allow significant economic advantages. Agricultural benefits still depend on several factors, such as: the level of public contribution depending on the environmental benefits (carbon sequestration, chemical fertiliser replacement); the increase of organic matter in the soil. The advantages of biochar should be evaluated in the long term to appreciate its benefits on soil.



#### KEY WORDS

Rural areas, biomass, by-product, circular bioeconomy, management, practices, technological innovations, agriculture, carbon credits

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**ADDITIONAL INFORMATION**

Biochar production by means of slow pyrolysis plants is a viable alternative to decentralised energy production from lignocellulosic biomass.

This method is particularly relevant as allows to reduce the import of charcoal and peat from other countries and may have a significant impact to decrease deforestation, especially in developing countries.

Indeed, in some countries of the world, deforestation and related soil depletion are due also to the production of biochar from wood.

Biochar can be a solution also for developing countries, as provides several advantages:

- Health: using fuel gas from pyrolysis/gasification plants instead of wood combustion to cook food eliminates toxic fumes which are now considered the fourth leading cause of human death globally.

- Environment:

- the very high internal surface area of biochar allows biochar to retain water and release it slowly;
- biochar can be used to improve soils of highly degraded and infertile lands;
- reduce the impact on deforestation by improving the energy efficiency.

- Social: the use of biochar minimizes the time spent to collect fuelwood and saves on fuel purchases, as

pyrolysis/gasification does not necessarily require wood, but can use also cheaper biomass types, as crop residues.



**ABOUT BRANCHES**

**BRANCHES** is a H2020

“Coordinaton Support Action” project, that brings together 12 partners from 5 different countries.

The overall objective of **BRANCHES** is to foster knowledge transfer and innovation in rural areas (agriculture and forestry), enhancing the viability and competitiveness of biomass supply chains and promoting innovative technologies, rural bioeconomy solutions and sustainable agricultural and forest management.

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**THE PARTNERSHIP**

