



TECHNICAL REPORT BIOCHAR

Biochar production from dry bio-residues as bio-fertiliser ingredient

SHORT SUMMARY FOR PRACTITIONERS

EN version

TNO was concerned with the production of biochar as one of the building blocks of the RUSTICA fertiliser mix. The technological process involves the heating of bio-residues to temperatures in the range 350-650°C, and for a period of 30 to 60 minutes. Heating is under oxygen-deficient concentrations and thus called gasification. Approximately 20-30% of the bio-residue is maintained as a very porous, carbon-rich product that is defined as biochar. The gasses released form a burnable gas that can replace natural gas in bio-energy generation. Quality of the biochars is essential for the use in a fertiliser and hereby we follow the guidelines of the European Biochar Certificate (EBC).

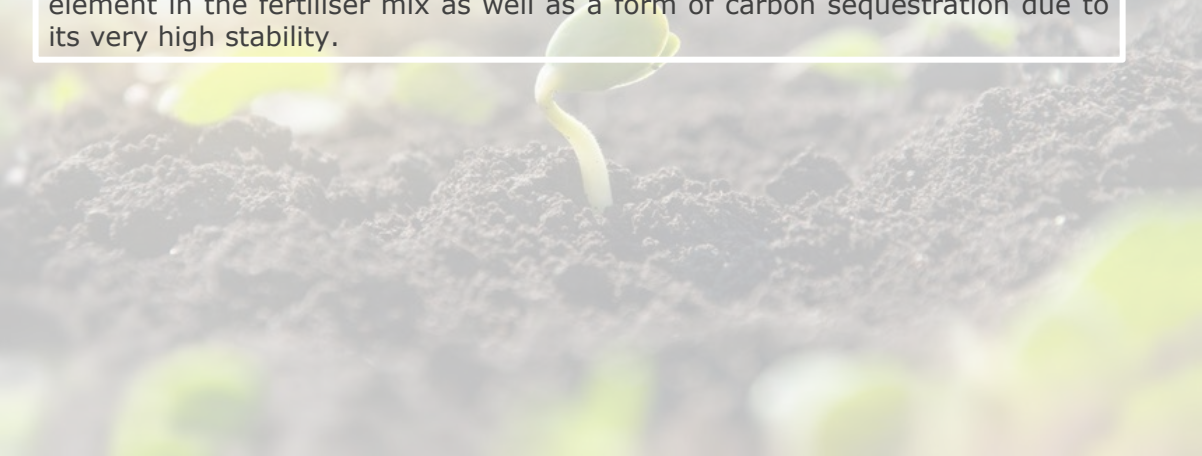
In total 18 biochars were produced from 15 different bio-residue feedstock. Three biochars were produced at low temperatures which potentially can be used as a slow-release fertiliser and will show faster decay than the biochars produced at the higher temperatures. However, the 350°C biochars did not comply with the EBC requirement of >50% carbon. As a result, it was decided to focus on the higher temperature production condition, at 650°C. High quality biochars were produced that can be a light-weight and structural element in the fertiliser mix as well as a form of carbon sequestration due to its very high stability.

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NATIVE version

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CONTEXT

The overall objective of the RUSTICA project is the technical validation, demonstration and implementation of bio-based fertiliser and soil improvement production techniques. Input streams are residues from the fruit and vegetable production. The bio-fertiliser thereby closes the nutrient cycles.

WHY BIOCHAR?

The woody type- and dryer plant residue materials can be composted at a relatively slow rate, transformed into bio-energy, or alternatively as done for RUSTICA, used to combine the production of biochar plus bio-energy. Biochar is a very porous and light-weight carbon product that has a number of advantages. In soil, the biochar provides good structural component qualities, such as air and water access. In addition, the very stable biochars also provide a form of carbon sequestration and have been shown to adsorb organic matter, increase micro-aggregate formation and thus fighting climate change while improving agricultural soils.

APPROACH

In total 18 type of bio-residues from 4 different regions, were converted in biochar and bio-energy at TNO in a lab-scale screw feeder reactor under slow-gasification conditions. Temperatures used were between 350-650°C and the residence time were 30-60 minutes. The biochars produced were all analysed to make sure that quality was excellent, following the European Biochar Certificate (EBC) guidelines. Material was sent back to consortium partners for pot trails and lessons learnt are being taking to upscaling the biochar production in the ENERCHAR pilot for future field trials.

OUTCOME

1. The three lower temperature (350°C) biochars, being less stable, can be used as a slow release fertiliser. However, these biochars did not comply with the EBC guidelines which requires a carbon content >50%.
2. It was decided then to use the higher temperature (650°C) conditions. A high ash content in the biochar was associated with a high salt and relatively low carbon content due to fertigation schemes for all greenhouse residues. Biochar qualities, however, were all excellent.
3. In order to come to a mixing procedure for the different regions, the biochars were grouped according to the ash and salts content in low, intermediate and high concentrations. Biochars can then be exchanged, depending on availability. E.g. Apple/Pear- versus Almond tree clippings.

PRACTICAL RECOMMENDATIONS

- It is recommended to use the biochar in the fertiliser mix as a light-weight structural material providing air and water access in soil.
- It is recommended to group the biochars according to the ash content which can directly be related to the fertigation scheme.
- Of the highly fertigated bio-residues it is recommended to use only 10-20% in combination with woody clippings to avoid high salt concentrations.
- In case of other high-nutrient streams to be used in the mixture, it is advised to only use woody-sources for the biochar.